Project Manual For:

Upper Dublin School District

New Jarrettown Elementary School

Work Scopes No. 1, No. 2, No. 3, and No.4

1520 Limekiln Pike, Dresher, PA 19025

Issue Date: October 29th, 2026

A LEGENCE Company

SECTION 00 00 10 – PROJECT MANUAL TITLE PAGE

OWNER:	**Upper Dublin School District** 1580 Fort Washington Avenue Maple Glen, PA 19002
PROJECT LOCATION:	**Jarrettown Elementary School** 1520 Limekiln Pike Dresher, PA 19025
CONSTRUCTION MANAGER:	**ICS Consulting, LLC** 1400 N. Providence Rd., Building 2, Suite 4045, Media, PA 19063 Phone: 610-424-4139 Project Manager: Ryan Murphy Email: ryan.murphy@ics-builds.com Direct: 610-368-2373
CIVIL ENGINEER:	**T&M Associates** 1700 Market Street, Suite 3110, Philadelphia, PA 19103 Phone: 610-234-4235 Contact: Mark Buchvalt Email: MBuchvalt@tandmassociates.com
MECHANICAL ENGINEER:	**CMTA, Inc.** 220 Lexington Green Cir, Suite 600, Lexington KY, 40503 Phone: 859-339-3475 Contact: Devin Cheek Email: DCheek@cmta.com
ELECTRICAL ENGINEER:	**CMTA, Inc.** 220 Lexington Green Cir, Suite 600, Lexington KY, 40503 Phone: 712-220-6231 Contact: Jonathan Walton Email: JWalton@cmta.com
STRUCTURAL ENGINEER:	**Barry Isett & Associates** 400 Cresson Blvd Suites 105-108, Phoenixville, PA 19460 Phone: 610-935-2175 Contact: Ross Sotak Email: RSotak@barryisett.com
ARCHITECT:	**ALLOY5, LLC.** 530 West Broad Street, Bethlehem, PA 18018 Phone: 610-419-4055 Contact: Jamie Bortz Email: jbortz@alloy5.com

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The Upper Dublin School District is soliciting sealed bids for Work Scope 1 through 4 for the New Jarrettown Elementary School Project located in Upper Dublin Township, Montgomery County, Pennsylvania. Sealed Bids for all work scopes shall be delivered to Ryan Murphy, Project Manager, no later than 9:00 AM prevailing time on Tuesday, December 1st, 2026, to the Upper Dublin School District Building, 1580 Ft Washington Ave, Maple Glen, PA 19002. The bid opening will be held at Upper Dublin Township Municipal Building, located at 801 Loch Alsh Ave, Fort Washington, PA 19034 at 10:00 AM prevailing time on Tuesday, December 1st, 2026 at which time bids will be publicly opened and read.

A MANDATORY pre-bid conference for ALL work scopes will be held at Upper Dublin Township Municipal Building, located at 801 Loch Alsh Ave, Fort Washington, PA 19034 at 10:00 AM prevailing time on Thursday, November 12th, 2026. Attendance by all Prime Bidders is mandatory.

Construction will be bid for the following Work Scopes.

Work Scope No. 1: General Construction
Work Scope No. 2: Electrical Construction
Work Scope No. 3: Mechanical Construction
Work Scope No .4: Plumbing/Fire Protection Construction

The Project Architect is ALLOY5, 530 W Broad St. Bethlehem, PA 18018, Phone: 610-419-4055. The Project Construction Manager is ICS Consulting, LLC, 1400 North Providence Road, Building 2, Suite 4045 Media, PA 19063, Phone: 610-424-4172.

Work Scope 1 through 4: Documents will be available digitally through the ICS Project Procore site. For electronic access to the bidding documents, contact the Project Coordinator, Theresa Kalman, at theresa.kalman@cmta.com. Bidders must supply the following information with their request for documents: the work scope(s) you are bidding on, company name, contact person, complete address, phone and cellular numbers, and email address. **Documents will be available on October 29th, 2026**.

This Project is subject to the Pennsylvania Prevailing Wage Act, (43 P.S. §§ 1651 et seq), as amended and supplemented. The Contractor shall comply with all requirements of the Act, and reference as made to the wage rates applicable to this Project.

Upper Dublin School District

Andrew Lechman, Chief Financial Officer

TO APPEAR: October 29th, 2026
November 5th, 2026
November 11th, 2026

SECTION 00 11 53 - CONTRACTOR QUALIFICATION STATEMENT

1.01 GENERAL

A. The AIA Document A305-2020 series forms with corresponding Exhibits that follow this page as listed below shall be completed by the Contractor and submitted in conjunction with Bids. Substitute forms will not be acceptable. All forms shall be fully executed by an authorized person and notary seals applied where indicated.

1. A305-2020, Contractors Qualification Statement
2. A305-2020, Exhibit A – General Information
3. A305-2020, Exhibit B – Financial and Performance Information
4. A305-2020, Exhibit C – Project Specific Information
5. A305-2020, Exhibit D – Contractor's Past Project Experience. Contractor may duplicate Exhibit D for as many project examples as needed.

END OF SECTION 00 11 53

AIA® Document A305® – 2020

Contractor's Qualification Statement

THE PARTIES SHOULD EXECUTE A SEPARATE CONFIDENTIALITY AGREEMENT IF THEY INTEND FOR ANY OF THE INFORMATION IN THIS A305-2020 TO BE HELD CONFIDENTIAL.

SUBMITTED BY:
(Organization name and address.)

SUBMITTED TO:
(Organization name and address.)
Upper Dublin School District
1580 Fort Washington Ave
Maple Glen, PA 19002

TYPE OF WORK TYPICALLY PERFORMED
(Indicate the type of work your organization typically performs, such as general contracting, construction manager as constructor services, HVAC contracting, electrical contracting, plumbing contracting, or other.)

THIS CONTRACTOR'S QUALIFICATION STATEMENT INCLUDES THE FOLLOWING:
(Check all that apply.)

[ ] Exhibit A – General Information
[ ] Exhibit B – Financial and Performance Information
[ ] Exhibit C – Project-Specific Information
[ ] Exhibit D – Past Project Experience

CONTRACTOR CERTIFICATION
The undersigned certifies under oath that the information provided in this Contractor's Qualification Statement is true and sufficiently complete so as not to be misleading.

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

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

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CONTRACTOR'S Authorized Representative *(Signature)*

(Printed name and title)

Date

NOTARY
State of:
County of:
Signed and sworn to before me this day of

Notary Signature
My commission expires:

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AIA® Document A305® – 2020 Exhibit A

General Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by and dated the day of in the year
(In words, indicate day, month and year.)

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

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

§ A.1 ORGANIZATION
§ A.1.1 Name and Location
§ A.1.1.1 Identify the full legal name of your organization.

§ A.1.1.2 List all other names under which your organization currently does business and, for each name, identify jurisdictions in which it is registered to do business under that trade name.

§ A.1.1.3 List all prior names under which your organization has operated and, for each name, indicate the date range and jurisdiction in which it was used.

§ A.1.1.4 Identify the address of your organization's principal place of business and list all office locations out of which your organization conducts business. If your organization has multiple offices, you may attach an exhibit or refer to a website.

§ A.1.2 Legal Status
§ A.1.2.1 Identify the legal status under which your organization does business, such as sole proprietorship, partnership, corporation, limited liability corporation, joint venture, or other.

.1 If your organization is a corporation, identify the state in which it is incorporated, the date of incorporation, and its four highest-ranking corporate officers and their titles, as applicable.

.2 If your organization is a partnership, identify its partners and its date of organization.

.3 If your organization is individually owned, identify its owner and date of organization.

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.4 If the form of your organization is other than those listed above, describe it and identify its individual leaders:

§ A.1.2.2 Does your organization own, in whole or in part, any other construction-related businesses? If so, identify and describe those businesses and specify percentage of ownership.

§ A.1.3 Other Information

§ A.1.3.1 How many years has your organization been in business?

§ A.1.3.2 How many full-time employees work for your organization?

§ A.1.3.3 List your North American Industry Classification System (NAICS) codes and titles. Specify which is your primary NAICS code.

§ A.1.3.4 Indicate whether your organization is certified as a governmentally recognized special business class, such as a minority business enterprise, woman business enterprise, service disabled veteran owned small business, woman owned small business, small business in a HUBZone, or a small disadvantaged business in the 8(a) Business Development Program. For each, identify the certifying authority and indicate jurisdictions to which such certification applies.

§ A.2 EXPERIENCE

§ A.2.1 Complete Exhibit D to describe up to four projects, either completed or in progress, that are representative of your organization's experience and capabilities.

§ A.2.2 State your organization's total dollar value of work currently under contract.

§ A.2.3 Of the amount stated in Section A.2.2, state the dollar value of work that remains to be completed:

§ A.2.4 State your organization's average annual dollar value of construction work performed during the last five years.

§ A.3 CAPABILITIES

§ A.3.1 List the categories of work that your organization typically self-performs.

§ A.3.2 Identify qualities, accreditations, services, skills, or personnel that you believe differentiate your organization from others.

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§ A.3.3 Does your organization provide design collaboration or pre-construction services? If so, describe those services.

§ A.3.4 Does your organization use building information modeling (BIM)? If so, describe how your organization uses BIM and identify BIM software that your organization regularly uses.

§ A.3.5 Does your organization use a project management information system? If so, identify that system.

§ A.4 REFERENCES

§ A.4.1 Identify three client references:
(Insert name, organization, and contact information)

§ A.4.2 Identify three architect references:
(Insert name, organization, and contact information)

§ A.4.3 Identify one bank reference:
(Insert name, organization, and contact information)

§ A.4.4 Identify three subcontractor or other trade references:
(Insert name, organization, and contact information)

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AIA® Document A305® – 2020 Exhibit B

Financial and Performance Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by and dated the day of in the year
(In words, indicate day, month and year.)

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

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

§ B.1 FINANCIAL

§ B.1.1 Federal tax identification number:

§ B.1.2 Attach financial statements for the last three years prepared in accordance with Generally Accepted Accounting Principles, including your organization's latest balance sheet and income statement. Also, indicate the name and contact information of the firm that prepared each financial statement.

§ B.1.3 Has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, been the subject of any bankruptcy proceeding within the last ten years?

§ B.1.4 Identify your organization's preferred credit rating agency and identification information.
(Identify rating agency, such as Dun and Bradstreet or Equifax, and insert your organization's identification number or other method of searching your organization's credit rating with such agency.)

§ B.2 DISPUTES AND DISCIPLINARY ACTIONS

§ B.2.1 Are there any pending or outstanding judgments, arbitration proceedings, bond claims, or lawsuits against your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A, Section 1.2, in which the amount in dispute is more than $75,000?
(If the answer is yes, provide an explanation.)

§ B.2.2 In the last five years has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 failed to complete work awarded to it?

.2 been terminated for any reason except for an owners' convenience?

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.3 had any judgments, settlements, or awards pertaining to a construction project in which your organization was responsible for more than $75,000?

.4 filed any lawsuits or requested arbitration regarding a construction project?

§ B.2.3 In the last five years, has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management; or any of the individuals listed in Exhibit A Section 1.2:
(If the answer to any of the questions below is yes, provide an explanation.)

.1 been convicted of, or indicted for, a business-related crime?

.2 had any business or professional license subjected to disciplinary action?

.3 been penalized or fined by a state or federal environmental agency?

§ B.2.4 List any debarments, suspensions, and denials of prequalification of the organization for any federal, state, local, or governmental contracting.

§ B.2.5 List any prevailing wage disputes, investigations, or complaints filed against the firm or any officers.

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AIA® Document A305® – 2020 Exhibit C

Project Specific Information

This Exhibit is part of the Contractor's Qualification Statement, submitted by and dated the day of in the year
(In words, indicate day, month and year.)

PROJECT:
(Name and location or address.)

New Jarrettown Elementary School
1520 Limeklin Pike
Dresher, PA 19025

CONTRACTOR'S PROJECT OFFICE:
(Identify the office out of which the contractor proposes to perform the work for the Project.)

TYPE OF WORK SOUGHT
(Indicate the type of work you are seeking for this Project, such as general contracting, construction manager as constructor, design-build, HVAC subcontracting, electrical subcontracting, plumbing subcontracting, etc.)

CONFLICT OF INTEREST
Describe any conflict of interest your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, or any of the individuals listed in Exhibit A Section 1.2, may have regarding this Project.

§ C.1 PERFORMANCE OF THE WORK
§ C.1.1 When was the Contractor's Project Office established?

§ C.1.2 How many full-time field and office staff are respectively employed at the Contractor's Project Office?

§ C.1.3 List the business license and contractor license or registration numbers for the Contractor's Project Office that pertain to the Project.

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

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

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§ C.1.4 Identify key personnel from your organization who will be meaningfully involved with work on this Project and indicate (1) their position on the Project team, (2) their office location, (3) their expertise and experience, and (4) projects similar to the Project on which they have worked.

§ C.1.5 Identify portions of work that you intend to self-perform on this Project.

§ C.1.6 To the extent known, list the subcontractors you intend to use for major portions of work on the Project.

§ C.2 EXPERIENCE RELATED TO THE PROJECT

§ C.2.1 Complete Exhibit D to describe up to four projects performed by the Contractor's Project Office, either completed or in progress, that are relevant to this Project, such as projects in a similar geographic area or of similar project type. If you have already completed Exhibit D, but want to provide further examples of projects that are relevant to this Project, you may submit additional copies of Exhibit D as needed.

§ C.2.2 State the total dollar value of work currently under contract at the Contractor's Project Office:

§ C.2.3 Of the amount stated in Section C.2.2, state the dollar value of work that remains to be completed:

§ C.2.4 State the average annual dollar value of construction work performed by the Contractor's Project Office during the last five years.

§ C.2.5 List the total number of projects the Contractor's Project Office has completed in the last five years and state the dollar value of the largest contract the Contractor's Project Office has completed during that time.

§ C.2.6 List any work the organization has performed for the Owner.

§ C.2.6 Other public work that the organization has performed in Pennsylvania (up to ten most recent projects). For each, identify the name and address of owner, location of project, nature of contract (prime, sub, etc.), contract amount, change orders, final contract amount, if completed on time, kind of work, and nature of project.

§ C.2.7 Other projects involving multi-prime contracts on which the organization has served as a prime contractor (up to ten most recent projects). For each, identify the name and address of owner, location of project, nature of

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contract (prime, sub, etc.), contract amount, change orders, final contract amount, if completed on time, kind of work, and nature of project.

§ C.2.8 Portion of the contract to the nearest ten percent (10%) that the bidder expects to perform using its own labor and equipment. The Bidder shall self-perform with its own employees not less than ten percent (10%) of the field construction work included in the Contract. Project management, supervision, safety management, overhead, profit, bonds, insurance, permit costs, and other administrative costs shall not be included in determining either the total value of work subject to this requirement or the value of self-performed work.

§ C.3 SAFETY PROGRAM AND RECORD

§ C.3.1 Does the Contractor's Project Office have a written safety program?

§ C.3.2 List all safety-related citations and penalties the Contractor's Project Office has received in the last three years.

§ C.3.3 Attach the Contractor's Project Office's OSHA 300a Summary of Work-Related Injuries and Illnesses form for the last three years.

§ C.3.4 Attach a copy of your insurance agent's verification letter for your organization's current workers' compensation experience modification rate and rates for the last three years.

§ C.4 INSURANCE

§ C.4.1 Attach current certificates of insurance for your commercial general liability policy, umbrella insurance policy, and professional liability insurance policy, if any. Identify deductibles or self-insured retentions for your commercial general liability policy.

§ C.4.2 If requested, will your organization be able to provide property insurance for the Project written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis?

§ C.4.3 Does your commercial general liability policy contain any exclusions or restrictions of coverage that are prohibited in Article 11 of the General Conditions? If so, identify.

§ C.5 SURETY

§ C.5.1 If requested, will your organization be able to provide a performance and payment bond for this Project?

§ C.5.2 Surety company name:

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§ C.5.3 Surety agent name and contact information:

§ C.5.4 Total bonding capacity:

§ C.5.5 Available bonding capacity as of the date of this qualification statement:

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AIA® Document A305® – 2020 Exhibit D

Contractor's Past Project Experience

	1	2	3	4
PROJECT NAME				
PROJECT LOCATION				
PROJECT TYPE				
OWNER				
ARCHITECT				
CONTRACTOR'S PROJECT EXECUTIVE				
KEY PERSONNEL (include titles)				
PROJECT DETAILS	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work	Contract Amount Completion Date % Self-Performed Work
PROJECT DELIVERY METHOD	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:	☐ Design-bid-build ☐ Design-build ☐ CM constructor ☐ CM advisor ☐ Other:
SUSTAINABILITY CERTIFICATIONS				

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SECTION 00 21 13 - INSTRUCTIONS TO BIDDERS

The INSTRUCTIONS TO BIDDERS, American Institute of Architects (AIA), AIA Document A701-2018, containing Articles 1 through 8, are hereby made part of this Project Manual and bound herein.

Refer to Section 01 11 00 – Summary of Work for scope of work for the bid packages.

AIA® Document A701® – 2018

Instructions to Bidders

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

New Jarrettown Elementary School
1520 Limeklin Pike
Dresher, PA 19025

THE OWNER:
(Name, legal status, address, and other information)

Upper Dublin School District
1580 Fort Washington Ave.
Maple Glen, PA 19002

THE CONSTRUCTION MANAGER:
(Name, legal status, address, and other information)

ICS Consulting, LLC (ICS)
1400 N. Providence Road
Building 2, Suite 4045
Media, PA 19063

THE ARCHITECT:
(Name, legal status, address, and other information)

Alloy5, LLC
530 West Broad Street
Bethlehem, PA 18018

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. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

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ARTICLE 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 Article 8 of 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.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

.1 the Bidder has read and understands the Bidding Documents;

.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 the Bid complies with the Bidding Documents;

.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;

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

.6 the Bidder has investigated all required fees, permits and regulatory requirements of authorities have jurisdiction and has properly included in the submitted bid the cost of such fees, permits and requirements not otherwise indicated as provided by the Owner. Refer to Specification Section 00 72 00 General Conditions of the contract for fees that the Owner is responsible for;

.7 the Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

.8 the Bidder is a properly licensed Contractor according to the laws and regulations of the State of Pennsylvania and meets the qualifications indicated in the Procurement and Contracting Documents;

a. 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 Commonwealth of Pennsylvania, or covenant to

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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.

b. In determining the lowest responsible Bidder, the Owner will consider the integrity, efficiency, and experience of the Bidder and its assigned personnel, promptness, current workload, financial capability, performance on recent projects, references from owners, architects, and engineers, list of potential sub-contractors, schedule of values, and ability to successfully and timely complete the Project. 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 the Bidder as non-responsive if all the information is not received on time and/or does not reasonably satisfy the Owner's evaluation process.

c. In addition to all the requirements listed above regarding qualifications of Bidders, the Owner will evaluate Bidders using the following additional criteria:

1) The Bidder and its assigned personnel must have successfully performed a minimum of 3 previous Pennsylvania public school projects within the last 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.

2) The Bidder shall self-perform with its own employees not less than ten percent (10%) of the field construction work included in the Contract. Project management, supervision, safety management, overhead, profit, bonds, insurance, permit costs, and other administrative costs shall not be included in determining either the total value of work subject to this requirement or the value of self-performed work.

3) The Bidder, or its assigned personnel, must have successfully performed at least 3 Pennsylvania public school projects within the last 5 years where they have managed multiple trades and coordinated and scheduled all the activities for projects as per above Article 1. Provide references including telephone number and contact person.

4) The Bidder's performance on previous projects including claims, litigation, coordination of work, staffing, and timely completion. If it is determined that the Bidder has not fully performed previous projects in a coordinated, timely, and good and workmanlike manner, the Owner reserves the right to reject the Bid.

d. All Bidders should be aware that the Owner encourages and promotes MBE (Minority Business Enterprise) and WBE (Women's Business Enterprise) participation for this Project. Bidders are encouraged to do their own research on the qualifications, and other factors, in preparing a comprehensive and responsible bid.

e. 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 finally 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.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

Bid documents are distributed electronically.

§ 3.1.2 The deposit sum, if any for the Bidding Documents is non-refundable.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents. Bidder is

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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.

a. 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, the required result can be produced under the Specifications and Drawings, and that the proposed schedule affords the Bidder sufficient time to complete the Work if award the Contract. No claim for any additional costs or additional time 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.

b. Should any Bidder find discrepancies, duplications, errors, 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 and/or Construction Manager. Where changes, corrections, or clarifications to Contract Documents are deemed necessary by the Architect and/or Construction Manager, 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. No claim for additional cost or time will be permitted for any discrepancies, duplications, errors, or omissions in the Contract Documents for any such matters that were apparent to the or discoverable by the Bidder though a complete review of the Contract Documents prior to submission of the bid.

c. 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 and/or Construction Manager by owners of such underground facilities or others. Owner and Architect and/or Construction Manager do not assume responsibility for the accuracy or completeness of the location of underground facilities at or contiguous to the site. Successful Bidder shall verify the location of all underground utilities prior to any excavation.

d. The Owner, Architect, and Construction Manager 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.

e. Successful Bidder for the General Contract 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, if any, or those 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 and Act 50 of 2017.

f. 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.

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g. 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.

h. 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 land 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.

i. The submission of a Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of the Bidding 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.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

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

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

§ 3.1.8 Retainage will be in accordance with the Contract Documents. Reference Article 9.3.4 of the General Conditions.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2 of these Instructions to Bidders.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect and Construction Manager at least seven days prior to the date for receipt of Bids. *(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)*

All Bidders shall submit requests for clarification or interpretation of the Bidding Documents through email to the parties listed in Article 3.4.2 of these Instructions to Bidders.

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as those established for submitting clarifications and interpretations in Section 3.2.2. 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" acceptable "approved" manufacturers and/or products for the Base Bid

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and alternate Bid as indicated. 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 for the Base Bid and alternate bid(s) as indicated. Bidders may request approval prior to Bid opening of non-listed items as substitutions in accordance with these specifications and Instructions to Bidders. No substitutions 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 days prior to the date for receipt of Bids. Such requests shall be in accordance with substitution request procedure listed in this Article 3.3 of these Instructions to Bidders, and any other requirements at the Architect, Owner, or Construction Manager's discretion. Unless the Bidder obtains approval of a substitution prior to the submission of Bids, 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 if the project is a multi-prime project.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form included in the Bidding Documents as Section 00 43 25 and should include:

a. 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.
b. Architect will review submission and any acceptable substitutions will be listed in an addendum. All manufacturers not specifically approved as a substitution by addendum shall not be considered.
c. Only manufacturers that are qualified prior to the Bid opening will be considered acceptable manufacturers.

§ 3.3.2.3 Intentionally deleted.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them. If a proposed substitution is not specifically approved by addendum, it shall be considered rejected.

§ 3.3.5 No substitutions will be considered after the Contract award absent proof that the specified item is not commercially available and cannot be provided through no fault of the Bidder.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

Addenda is distributed electronically to all Contacts on the current invited bidder list and to any others upon request.

§ 3.4.2 All questions about the meaning or intent of the Contract Documents are to be directed to the parties listed below. Interpretations or clarifications considered necessary by the Architect in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Architect and/or Construction Manager as having received the Bidding Documents. Questions received less than five (5) days prior to the date for opening of Bids may not be answered. Only interpretations or clarifications issued by formal written Addenda will be binding. Oral or other interpretations or clarifications will be without legal effect. All questions must be submitted in writing as follows. Phone calls are not permitted.

a. All questions must be sent to:
ALLOY5, LLC.
Jamie Bortz, jbortz@alloy5.com

b. All ME questions must be copied to:
CMTA, Inc.

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Mechanical Engineer - Devin Cheek, DCheek@cmta.com
Electrical Engineer - Jonathan Walton, JWalton@cmta.com

c. All Civil questions must be copied to:
T&M Associates
Mark Buchvalt, MBuchvalt@tandmassociates.com

d. All Structural questions must be copied to:
Barry Isett & Associates
Ross Sotak, RSotak@barryisett.com

e. All questions must be copied to:
ICS Consulting, LLC
Ryan Murphy, ryan.murphy@ics-builds.com

§ 3.4.3 Addenda may also be issued at any time to modify the Bidding Documents as deemed advisable by Construction Manager, Owner, or Architect.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt of each Addendum in the space indicated on the Project Bid Form(s).

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Pre-Bid Conference

§ 4.1.1 The Pre-bid Conference will be held on the date and time listed in the Advertisement for Bids. Representatives of Owner, Construction Manager, and Architect will be present to discuss the Project. Architect and Construction Manager will transmit to all prospective Bidders of record such Addenda, as Architect considers necessary in response to questions arising at the Conference.

§ 4.1.2 The site may be made available for visits at the pre-bid conference and at the other specific dates and times determined at the pre-bid.
(Paragraphs deleted)

§ 4.2 Preparation of Bids

§ 4.2.1 Bids shall be submitted in duplicate on the forms included with or identified in the Bidding Documents. THE BID FORM SHALL NOT BE ALTERED. ALTERED BID FORMS MAY BE CONSIDERED NON-RESPONSIVE AND MAY BE REJECTED.

§ 4.2.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.2.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.2.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.2.5 Alternates:

a. 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.

b. The Owner shall have the right to accept or reject alternates in any order or combination, and to determine the low Bidder on the basis of the sum of the Base Bid and alternates accepted.

c. 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.

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d. The Bidder shall provide a response for every Alternate listed on the Bid Form by entering an ADD amount, a DEDUCT amount, "NO CHANGE," or "NO BID," as applicable. "NO CHANGE" indicates that the Bidder shall perform the Alternate Work with no adjustment to the Base Bid.

e. "NO BID" indicates that the Bidder declines to provide the Alternate Work. Failure to provide a response for any Alternate shall be treated as a "NO BID". If the Owner elects to accept an Alternate for which the Bidder has entered "NO BID," the Bidder shall not be eligible for award of the Contract.

f. Enter the amount for each alternate on the line pre-marked as "ADD" and/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.

g. The failure to enter an amount of "NO CHANGE" or "NO BID" in the blanks for an alternate shall be treated conclusively as a Bid of zero dollars for the work described in the alternate.

§ 4.2.6 The Bid shall contain an acknowledgment 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.

§ 4.2.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.2.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2.9 Bidder shall include all applicable sales and use taxes in its bid. Bidder shall consult Section 3.6 of the General Conditions regarding the Owner's exemption from sales and use tax on "building machinery and equipment" and comply with all provisions set forth therein.

§ 4.3 Bid Security

§ 4.3.1 Each Bid shall be accompanied by the following bid security:
(Insert the form and amount of bid security.)

Certified Check or Bid Bond in the amount of ten percent (10%) of the total bid

(Paragraphs deleted)

§ 4.3.2 No bid will be considered unless it is accompanied by a Bid Security in the amount of ten percent (10%) of the total bid payable without condition to the Owner. Bid Security shall be in the form of a Certified/Bank Cashier's Check or Bid Bond in the form provided in the documents, and shall be submitted with the express understanding that it shall be a guarantee that the Bidder will not withdraw his/her bid for a period of sixty (60) days after the date specified for receipt of bids, that the Bidder will enter into a formal Contract with the Owner; and that the Bidder will submit the required Performance, Labor and Material Payment Bonds, Public Works Employment Verification Forms and Certificates of Insurance as specified. In the event of withdrawal of the Bid by the Bidder, the Bidder will forfeit the full amount of the Bid Bond (Guarantee). All Certified Checks will be returned to the Bidders after the Owner and the successful Bidder have executed the Contract; and the executed Performance and Labor and Material Payment Bonds and Certificate of Insurance have been approved by the Owner.

§ 4.3.3 If Bid Bond is provided as the bid security, it shall be written on the form provided in the Bidding Documents. No other forms will be accepted. The attorney-in-fact who executes the Agreement or Surety or bid bond on behalf of the surety shall affix a certified and current copy of an acceptable 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, or if dated prior to the date of the submission of the bid security, the Power of Attorney shall have a Certification that certifies that the Power of Attorney remains in full force and effect as of the date of the bid security, and both the bid security and Power of Attorney shall have affied 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

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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.

§ 4.3.4 If the Bid Security is submitted in the form of a certified check or bank cashier's check, the Bidder shall submit an Agreement of Surety certifying that a surety company will provide the Bidder with a Performance Bond and Payment Bond each in the amount of one hundred percent (100% of the Contract Sum). The Agreement of Surety shall be in the form included in the Bidding Documents as Section 00 43 15. The Agreement of Surety shall be executed by a surety satisfying the requirements set forth in the Contract Documents.

§ 4.3.5 The Owner will have the right to retain the bid security of the three (3) lowest Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning Sixty-One (61) days after the opening of Bids, withdraw its Bid and request the return of its bid security. Upon request, the Bid Security of the other Bidders will be returned by the Owner after the Owner and successful Bidder have executed a Contract. The Owner shall not be liable for any interest on Bid Security which is held in accordance with these Instructions to Bidders.

§ 4.4 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

Paper copy of the bid, bid security and any other documents required enclosed in a sealed envelope, addressed/labeled per instructions and delivered to the Bid Opening site prior to the bid date / time.

(Paragraphs deleted)

§ 4.4.2 Paper copies of the Bid, the bid security, and any other documents listed in Specification Section 00 43 93, Bid Submittal Attachments, are required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.4.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.4.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.4.5 A Bid submitted by any method other than as provided in this Section 4.4 will not be accepted.

§ 4.5 Modification or Withdrawal of Bid

§ 4.5.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.5.2 Bids shall be irrevocable for sixty (60) days after the actual day of opening thereof unless the Owner is delayed in awarding the Contract due to the failure to receive a required approval/permit from one or more reviewing bodies/governmental agencies having jurisdiction over the Project, the sale of bonds, or the award of a grant, in which case, Bids shall be irrevocable for 120 days after Bid opening. Absent an exception for extending time for the award of the Contract, the Owner and the lowest responsible and responsive Bidder may mutually agree in writing to extend the time for the Owner to award the Contract.

§ 4.5.3 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

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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.

§ 4.5.4 Negligence by the Bidder in preparing his Bid 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, after the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two 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. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.5.4, then (1) the withdrawing bidder shall not supply any material or labor to, or perform any subcontract or other work agreement for any person to whom a contract or subcontract is awarded in the performance of the contract for which the withdrawn bid was submitted, without the written approval of the Owner, (2) , the Owner may award the contract to the next lowest responsive and responsible bidder or reject all bids and rebid, (3) if the Owner elects to rebid, then the withdrawing bidder shall pay the costs of printing new contract documents and required advertising and upon receipt of such costs, the Owner will return the withdrawing bidder's bid security, and (4) if the Owner elects to award to the next lowest responsible and responsive bidder, then the Owner will return the bid security of the withdrawing Bidder following execution of the contract with the next lowest responsible and responsive bidder.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders after opening of the Bids.

§ 5.2 Rejection of Bids

§ 5.2.1 The Owner shall have the right to reject any or all Bids.

§ 5.2.2 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, notarized, and submitted with the Bidder's proposal using the form set forth in Specification Section 00 45 19.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. The Owner reserves the right to reject any and all bids. The Owner reserves the right to waive informalities and irregularities, technicalities, or non-material defects in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests and in accordance with law. The Owner reserves 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 the Bidding Documents. Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the correct sum.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted. Alternates offered by the Bidder and not listed on the Bid Form will not be considered; nor will they be a determining factor in the low Bidder.

§ 5.3.3 In evaluating Bids, Owner will consider the qualifications of such Bidders, 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.

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§ 5.3.4 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.

§ 5.3.5 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.

§ 5.3.6 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 extended as set forth in these Instructions to Bidders.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Intentionally deleted.

§ 6.2 Owner's Financial Capability

Intentionally deleted.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

- **.1** a designation of the Work to be performed with the Bidder's own forces;
- **.2** names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- **.3** 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 including commercial general liability insurance, automotive liability insurance, and worker's compensation insurance, adequate resources of manpower, tools, and equipment and must meet the IRS criteria for an independent contractor. Contractors shall reference the IRS website for the definition of an independent contractor: https://www.irs.gov/businesses/small-businesses-self-employed/independent-contractor-self-employed-or-employee

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Intentionally deleted.

§ 6.3.4 Intentionally deleted.

§ 6.3.5 Pennsylvania Prevailing wage rates will apply to this project. The Contractor and its subcontractors shall comply with the provisions, duties, obligations, remedies, and penalties of the Pennsylvania Prevailing Wage Act, 43 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.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 The Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 Refer to Specification Section 00 72 00 General Conditions of the Contract for Construction for complete Bond Requirements.

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§ 7.1.3 The apparent low Bidder must provide Payment and Performance Bonds in the forms included in the Contract Documents, Public Works Employment Verification Form, and all Certificates of Insurance or other insurance information as required pursuant to the General Conditions of the Contract 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.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

(Paragraphs deleted)
§ 7.1.5 The bonds shall be dated on or before the date of the Contract.

§ 7.1.6 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A132™–2019, Standard Form of Agreement Between Owner and Contractor, as modified, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.2 Intentionally Omitted as it is Not Applicable

.3 AIA Document A232™–2019, General Conditions of the Contract for Construction, as modified, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.4 Intentionally Omitted as it is Not Applicable

.5 Drawings:
Exhibit A

(Table deleted)

.6 Specifications:
Exhibit B

(Table deleted)

.7 Addenda:
As issued prior to the Bid Date published in the Bidding Documents

(Table deleted)

.8 Other Exhibits:
Exhibit C – Contractor's completed Bid Form
Exhibit D - Contractor's executed Non-Collusion Affidavit
Exhibit E – Contractor's executed Public Work Employment Verification Form
Exhibit F – Contractor's executed Performance and Payment Bonds
(Paragraphs deleted)
Exhibit G – Contractor's Certificate of Insurance

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(Table deleted)

.9 Other documents listed below:
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

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SECTION 00 22 20 – BACKGROUND CHECKS & VERIFICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements governing clearance requirements of all Contracts, inclusive of Prime Contractors and their subcontractors.

1.03 REQUIRED CLEARANCES AND VERIFICATIONS

A. Competent Workmen, Prohibition of Illegal Alien Labor / Public Works Employment Verification Act

1. 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, and paid the applicable prevailing wage pursuant to Article 3.4.10 of the General Conditions.
2. Pursuant to the Act of May 11, 2006, (P.L. 173, No. 43), known as the Prohibition of Illegal Alien Labor on Assisted Projects Act, Contractor shall not knowingly employ, or knowingly permit any of its subcontractors to knowingly employ, the labor services of an illegal alien.
3. The Commonwealth of Pennsylvania enacted Act 141 of 2022, 71 P.S. Secs. 656.1-656.11, known as the Public Works Employment Verification Act (‘the Act’ or ‘Act 141’) 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 Contractor and its Subcontractor (as such term is defined in the Act) are required to comply with the Act and the Statement of Policy as published in the Pennsylvania Bulletin, July 22, 2023, and effective January 3, 2023. A separate and complete Verification Form required by the Public Works Employment Verification Act, Act No. 141 or 2022, 71 P.S. Secs. 656.1-656.11, (formerly Senate Bill 637 and Act 127) for itself and each of the proposed Subcontractors (as such term is defined therein) acknowledging its responsibilities and its compliance with the Public Works Employment Verification Act as a precondition of the Owner's Award of the Contract. The Act

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 Contractor and its subcontractor (as such term is defined in the Act) are required to comply with the Act and the Statement of Policy as published in the Pennsylvania Bulletin, July 22, 2023, and effective January 3, 2023. The Verification Form shall include a certification that the information is true and correct, subject to sanctions provided by law. The respective Verification Form shall be executed by a representative who has sufficient knowledge and authority to make the representations and certifications contained in the Verification Form. Form included as Section 00 22 21.

4. A "Public Work" is defined 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.
5. The Department of General Services' Public Works Employment Verification Compliance Program is responsible for the administration, education and enforcement of the Act. It provides contractors and subcontractors with educational outreach, conducts investigations when complaints are received and random audits to ensure compliance with the requirements of the Act. Please direct your questions to the Public Works Employment Verification Compliance.

1.04 BACKGROUND CHECKS

Pennsylvania School Law, as required by Act 151 and Act 114 of 2006, as amended, requires that all applicants for employment in public and private schools, and employees of independent contractors seeking business with public and private schools undergo background checks if they will have direct contract with students. Prior to commencing Work, the Contractor and each Subcontractor shall submit on the prescribed form listed below for each employee or person performing work at the Project site on behalf of the Contractor and Subcontractor prior to such person performing any work at the Project site. The original clearances must be presented to the Owner prior to each employee, agent or subcontractor coming on the Owner's property. 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.

Owner shall review the clearance submissions prior to each individual being permitted to come onto the Owner's property. The Owner reserves the right to reject any employee, agent or subcontractor that the Owner determines in its sole discretion has an unsatisfactory criminal history or child abuse clearance. 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. Any individual rejected by the Owner shall not be permitted on the Owner's property. Owner's right to declare such person unfit shall not be limited to the required exclusion of persons from direct contact with children as set forth in Section 1-111 of the Pennsylvania Public School code and/or Subchapter C2 of

the Child Protective Services Law.

Each employee or person performing work at the Project site on behalf of the Contractor or Subcontract must complete each of the following clearances:

1. **Department of Human Services (DHA) Child Abuse History**

   Act 151 of December 16, 1994: Official clearance statement obtained from the Pennsylvania Department of Public Welfare pursuant to Act 151 of December 16, 1994 (P.L. 1292), subchapter C.2 of the Child Protective Services Law, as amended from time to time. Form included as Section 00 22 22. **Child Abuse reports shall be no more than one (1) year old at the time of employment.** Form is included as Section 00 22 22.

   Procedure for Obtaining Child Abuse History Clearance:

   a. You may obtain forms from schools or the Department of Human Services website. http://keepkidssafe.pa.gov/resources/clearances/index.htm.
   b. The Pennsylvania Child Abuse History Clearance can be submitted and paid online through the Child Welfare Information Solutions (CWIS) self-service portal, https://www.compass.state.pa.us/cwis/public/home, or mailed in.
   c. If you chose to mail the form, please enclose money order or check for each application in the amount indicated. No cash accepted. Personal, agency or business checks are acceptable.
   d. Clearances results will be mailed within 14 days from the date that the clearance is received. There will be no replacement after 90 days.
   e. Indicate SCHOOL as the “Purpose of Clearance.”
   f. For status of a request, please call the Department of Human Services, Childline and Abuse Registry at (717) 783-6211.

2. **Pennsylvania Access to Criminal History (PATCH)**

   Act 34 of 1985: Original report of criminal history record information from the Pennsylvania State Police or a statement from the Pennsylvania State Police that the Pennsylvania State Police central repository contains no such information relating to any of Contractor’s employees or its subcontractor’s employees working on the Project site prior to such persons performing work at the Project site. **Clearances shall be dated no earlier than one year prior to the date presented to the Owner, but** such report of criminal history shall be no older than sixty (60) months old at any time the individual performs services under this Agreement. To obtain this document, contact the nearest Pennsylvania State Police barracks. Form included as Section 00 22 23.

   Procedures for obtaining the PA State Police Background Clearance and associated costs can be found via the following link:
   https://www.psp.pa.gov/Pages/Request-a-Criminal-History-Record.aspx#.U_Y5c010zlV.

3. Federal Criminal History Record Information (CHRI) – FBI Report

Act 114 of 2006, 24 PS 1-111 as amended (Act 61 of 2008): Copy of the Federal Criminal History record from the Federal Bureau of Investigation in the manner prescribed by the Department of Education. **Clearances shall be dated no earlier than one year prior to the date presented to the Owner**. The fingerprint-based background check is a multiple-step process, as follows:

a. **Registration** - The applicant must register prior to going to the fingerprint site. Walk in service is allowed but all applicants are required to complete pre-enrollment in the new Universal Enrollment system. Pre- enrollment can be completed online or over the phone. The registration website is available online 24 hours/day, seven days per week at https://uenroll.identogo.com/ Telephonic registration is available at 1- 844-321-2101 Monday through Friday, 8am to 6pm EST. During the pre-enrollment process, all demographic data for the applicant is collected (name, address, etc.) along with notices about identification requirements and other important information.

b. When registering on-line, an applicant must use the PA Department of Education specific Service ***Code #1KG6XN.*** Fingerprint requests processed through any other agency or purpose cannot be accepted and are not transferrable. If an applicant enters the wrong code by mistake, the incorrect applicant type will appear at the top of the screen. The applicant should select the “Back to Home” button and begin the process again, by reentering the correct Service Code. If the applicant proceeds with the process under the incorrect code, the pre-enrollment and/or results cannot be transferred to another state agency and the applicant will have to start the process over and pay for the background check again.

c. Payment - The applicant will pay for the fingerprint service and to secure an unofficial copy of the Criminal History Record. Major Credit Cards as well as Money orders or cashier’s checks payable to MorphoTrust will be accepted on site for those applicants who are required to pay individually. Applicants shall verify the cost of the clearance if using money order or cashier’s check. No cash transactions or personal checks are allowed.

d. IDEMIA has also established a payment option for fingerprinting services for entities interested in paying the applicant’s fee. This new option provides a payment ‘coupon’ that the entity will provide to each applicant for use. Each coupon is unique and may only be used one time. Account applications must be completed prior to the applicant visiting the fingerprint site. The authorized representative must complete the account application. To establish a billing account, you will need to complete an application at https://www.identogo.com/uploads/general/PA_NCAC_Package_Fillable_Fields.pdf with IDEMIA.

e. Fingerprint Locations – After registration, the applicant proceeds to the fingerprint site of their choice for fingerprinting. The location of the fingerprint sites and days and hours of operation for each site are posted on IDEMIA's website at https://uenroll.identogo.com/ . The location of fingerprint sites may change over time; applicants are encouraged to confirm the site location nearest to their location. PDE encourages entities where access to the fingerprint location is more than 25 miles away to

contact IDEMIA and suggest areas where another closer site could be established.

f. Fingerprinting - At the fingerprint site the Enrollment Agents (EA) manages the fingerprint collection process. The fingerprint transaction begins when the EA reviews the applicant's qualified State or Federal photo ID before processing the applicant's transaction. Applicants will not be processed if they cannot produce an acceptable photo ID. After the identity of the applicant has been established, all ten fingers are scanned to complete the process. The entire fingerprint capture process should take no more than three to five minutes.

g. Report Access – For the public or private school or higher education institution to access the official report via the electronic system, applicants must present their UEID to the hiring entity (as shown on the receipt provided after fingerprint capture). This process allows an applicant to provide multiple potential employers with their UEID, as the report is linked to the UEID number and not assigned to a specific school. If an applicant has lost their receipt or needs to confirm UEID, the applicant may visit the UEP website (https://uenroll.identogo.com/) and simply check status of their file by providing alternate personal information. Applicants will enter their personal information after clicking in the lower portion of that screen to obtain their receipt with the UEID.

h. Applicants will receive an unofficial copy of their report.

4. **Act 24: Reporting Arrests and Convictions**

Act 24 of 2011 contains a number of significant changes to the Pennsylvania Public School Code that are designed to enhance the safety of school children. Among the changes, Act 24 amends Section 111 of the School Code to expand the list of prohibitive criminal offenses and ensure that then-current employees or those who will have contact with school children who may have been subject to a previous background check were required to provide assurances that they had not been previously arrested or convicted of a Section 111(e) offense.

Act 24 of 2011 and Act 82 of 2012: Original background check in accordance with Section 111 of the Public School Code of 1949, Act 34 of March 10, 1949, P.L. 30, No. 14, as amended by from time to time including, without limitation, by Act 114 of July 11, 2006, P.L. 1092, and Act 24 of 2011 (P.L. 112, No. 24) (24 P.S. Section 1-111, et seq.) on the form PDE 6004, Arrest/Conviction Report and Certification Form, published by the Pennsylvania Department of Education. The Contractor shall require employees performing at the Project Site on behalf of the Contractor and/or its Subcontractors to file form PDE-6004 within seventy-two (72) hours of an arrest or conviction of an offense listed in Section 1-111(e)of the Pennsylvania School Code. Contractor shall immediately notify the Owner in writing of such filing and shall preclude the affected employee from performing any work at the Project Site. The Owner shall also have the right to prohibit any such individual from coming onto its property. Form included as Section 00 22 24.

5. **Act 168: Commonwealth of Pennsylvania Sexual Misconduct/Abuse Disclosure Release**

   Act 168 of 2014: "Commonwealth of Pennsylvania Sexual Misconduct/Abuse Disclosure Release" has been developed by the Pennsylvania Department of Education, pursuant to Act 168 of 2014, to be used by school entities and independent contractors of school entities and by applicants who would be employed by or in a school entity in a position involving direct contact with children to satisfy the Act's requirement of providing information related to abuse or sexual misconduct. As required by Act 168, in addition to fulfilling the requirements under Section 1-111 of the School Code and the Child Protective Services Law ("CPSL"), an applicant who would be employed by or in a school entity in a position having direct contact with children, must provide the information requested in SECTION 1 of this form and complete a written authorization that consents to and authorizes the disclosure by the applicant's current and former employers of the information requested in SECTION 2 of this form. The applicant shall complete one form for the applicant's current employer(s) and one for each of the applicant's former employers that were school entities or where the applicant was employed in a position having direct contact with children (therefore, the applicant may have to complete more than one form). Upon completion by the applicant, the hiring school entity or independent contractor shall submit the form to the applicant's current and former employers to complete SECTION 2. A school entity or independent contractor may not hire an applicant who does not provide the required information for a position involving direct contact with children. No employee or person who has been convicted of any of the offenses enumerated under 24 P.S. Section 1-111(e) shall be permitted to perform any work at the Project Site. Form included as Section 00 22 25.

   PDFs of required clearance and verification forms can be found in the Project Manual as the followings Sections:

   a. 00 22 21Act 141: Public Works Employment Verification Form
   b. 00 22 22Act 151: Child Abuse Clearance Form
   c. 00 22 23Act 34: Pennsylvania State Police Clearance Form
   d. 00 22 24Act 24/Act 82: PDE Form 6004
   e. 00 22 25Act 168: PA Sexual Misconduct-Abuse Disclosure Release

For additional information regarding the PDE Clearances and Background Checks please visit: https://www.education.pa.gov/Educators/Clearances/Pages/default.aspx

END OF SECTION 00 22 20



Commonwealth of Pennsylvania

Public Works Employment Verification Form

Complete and return the form to the contracting Public Body prior to the award of the contract.

Company Legal Name: _____

Doing Business As: _____
(if different from Legal Name)

Mailing Address: _____
Street Address 1

_____
Street Address 2

_____
City State Zip Code

Check one: ☐ Contractor ☐ Subcontractor

Contracting Public Body: _____

Contract/Project Number: _____

Project Description: _____

Project Location: _____

Date Enrolled in E-Verify (MM/DD/YYYY): _____

As a contractor/subcontractor for the above referenced public works contract, I hereby affirm that as of today's date, _____**,** our company is in compliance with the Public Works Employment Verification Act ('the Act') through utilization of the federal E-Verify Program (EVP) operated by the United States Department of Homeland Security. To the best of my/our knowledge, all employees hired are authorized to work in the United States.

It is also agreed to that all public works contractors/subcontractors will utilize the federal EVP to verify the employment eligibility of each new hire within five (5) business days of the employee start date throughout the duration of the public works contract. Documentation confirming the use of the federal EVP upon each new hire shall be maintained in the event of an investigation or audit.

I,_____, authorized representative of the company above, attest that the information contained in this verification form is true and correct and understand that the submission of false or misleading information in connection with the above verification shall be subject to sanctions provided by law.

_____ _____
Authorized Representative Signature **Date of Signature**

Printed Name: _____

Phone Number: _____ **Email:** _____

PENNSYLVANIA CHILD ABUSE HISTORY CERTIFICATION

Type or print clearly in ink. If obtaining this certification for non-volunteer purposes or if, as a volunteer having direct volunteer contact with children, you have obtained a certification free of charge within the previous 57 months, enclose an $13.00 money order or check payable to the PENNSYLVANIA DEPARTMENT OF HUMAN SERVICES or a payment authorization code provided by your organization. **DO NOT send cash.**

Certifications for the purpose of "volunteer having direct volunteer contact with children" may be obtained free of charge once every 57 months.

Send to CHILDLINE AND ABUSE REGISTRY, PA DEPARTMENT OF HUMAN SERVICES, P.O. BOX 8170 HARRISBURG, PA 17105-8170.

APPLICATIONS THAT ARE INCOMPLETE, ILLEGIBLE OR RECEIVED WITHOUT THE CORRECT FEE WILL BE RETURNED UNPROCESSED. IF YOU HAVE QUESTIONS CALL 717-783-6211, OR (TOLL FREE) 1-877-371-5422.

PURPOSE OF CERTIFICATION (Check one box only)

- ☐ Foster parent
- ☐ Prospective adoptive parent
- ☐ Employee of child care services
- ☐ School employee governed by the Public School Code
- ☐ School employee not governed by the Public School Code
- ☐ Self-employed provider of child-care services in a family child-care home
- ☐ An individual 14 years of age or older applying for or holding a paid position as an employee with a program, activity, or service
- ☐ An individual seeking to provide child-care services under contract with a child care facility or program
- ☐ An individual 18 years or older who resides in the home of a foster parent for children for at least 30 days in a calendar year
- ☐ An individual 18 years or older who resides in the home of a certified or licensed child-care provider for at least 30 days in a calendar year
- ☐ An individual 18 years or older, excluding individuals receiving services, who resides in a family living home, community home for individuals with an intellectual disability, or host home for children for at least 30 days in a calendar year
- ☐ An individual 18 years or older who resides in the home of a prospective adoptive parent for at least 30 days in a calendar year
- ☐ Volunteer having direct volunteer contact with children

  If purpose is volunteer having direct volunteer contact with children, choose SUB PURPOSE:
  - ☐ Big Brother/Big Sister and/or affiliate
  - ☐ Domestic violence shelter and/or affiliate
  - ☐ Rape crisis center and/or affiliate
  - ☐ Other: _____
- ☐ PA Department of Human Services Employment & Training Program participant (signature required below)

SIGNATURE OF OIM/CAO REPRESENTATIVE _____ OIM/CAO PHONE NUMBER _____

AGENCY/ORGANIZATION NAME:	PAYMENT AUTHORIZATION CODE, IF APPLICABLE:

☐ Consent/Release of Information Authorization form is attached. Applicant must fill in the "Other Address" sections. By completing the other address sections, you are agreeing that the organization will have access to the status and outcome of your certification application.

APPLICANT DEMOGRAPHIC INFORMATION (DO NOT USE INITIALS)

FIRST NAME	MIDDLE NAME	LAST NAME	SUFFIX
SOCIAL SECURITY NUMBER ___ ___	GENDER ☐ Male ☐ Female ☐ Not reported	DATE OF BIRTH (MM/DD/YYYY)	AGE

Disclosure of your Social Security number is voluntary. It is sought under 23 Pa.C.S. §§ 6336(a)(1) (relating to information in statewide database), 6344 (relating to employees having contact with children; adoptive and foster parents), 6344.1 (relating to information relating to certified or licensed child-care home residents), and 6344.2 (relating to volunteers having contact with children). The department will use your Social Security number to search the statewide database to determine whether you are listed as the perpetrator in an indicated or founded report of child abuse.

HOME ADDRESS	MAILING ADDRESS (if different from home address)	OTHER ADDRESS (if Consent/Release of Information Authorization form is attached)
ADDRESS LINE 1	ADDRESS LINE 1	ADDRESS LINE 1
ADDRESS LINE 2	ADDRESS LINE 2	ADDRESS LINE 2
CITY	CITY	CITY
COUNTY	COUNTY	COUNTY
STATE/REGION/PROVINCE	STATE/REGION/PROVINCE	STATE/REGION/PROVINCE
ZIP/POSTAL CODE	ZIP/POSTAL CODE	ZIP/POSTAL CODE
COUNTRY	COUNTRY	COUNTRY
☐ Different mailing address	ATTENTION	ATTENTION

CONTACT INFORMATION

HOME TELEPHONE NUMBER	WORK TELEPHONE NUMBER	MOBILE TELEPHONE NUMBER

EMAIL (By submitting an email contact, you are agreeing to ChildLine contacting you at this address.)

PENNSYLVANIA CHILD ABUSE HISTORY CERTIFICATION

PREVIOUS NAMES USED SINCE 1975 (Include maiden name, nickname and aliases.)			
First	**Middle**	**Last**	**Suffix**
1.			
2.			
3.			
4.			
5.			

PREVIOUS ADDRESSES SINCE 1975 (Please list all addresses since 1975, partial address acceptable; attach additional pages if necessary.)
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

HOUSEHOLD MEMBERS
(Please list everyone who lived with you at any time since 1975 to present.
Please include parent, guardian or the person(s) who raised you; attach additional pages as necessary.)

Name (First, Middle, Last)	Relationship	Present Age	Gender
1.	☐ Parent ☐ Guardian ☐ person(s) who raised you		
2.	☐ Parent ☐ Guardian ☐ person(s) who raised you		
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

I affirm that the above information is accurate and complete to the best of my knowledge and belief and submitted as true and correct under penalty of law (Section 4904 of the Pennsylvania Crimes Code). If I selected volunteer, I understand that I can only use the certificate for volunteer purposes.

APPLICANT'S SIGNATURE

DATE

CHILDLINE USE ONLY		
DATE RECEIVED BY CHILDLINE	SUFFICIENT PAYMENT INFORMATION RECEIVED ☐ YES ☐ NO ☐ VALID PAYMENT AUTHORIZATION CODE ☐ WAIVED (supervisor initials) _____	CERTIFICATION ID #

INSTRUCTIONS TO COMPLETE THE PENNSYLVANIA CHILD ABUSE HISTORY CERTIFICATION APPLICATION:

General:

- Type or print clearly and neatly in ink only.
- If obtaining this certification for non-volunteer purposes or if, as a volunteer having direct volunteer contact with children, you have obtained a certification free of charge within the previous 57 months, enclose an $13.00 money order or check for each application. No cash will be accepted. Personal, agency, or business checks are acceptable. Certifications for the purpose of "volunteer having direct volunteer contact with children" may be obtained free of charge once every 57 months. If no payment is enclosed for a non-volunteer purpose, you must provide a payment authorization code, otherwise your application will be rejected and returned to you.
- **DO NOT SEND POSTAGE PAID RETURN ENVELOPES** for us to return your results. Results are issued through an automated system generated mailing process.
- Certification results will be mailed to you within 14 days from the date the certification application is received at the ChildLine and Abuse Registry.
- Failure to comply with the instructions will cause considerable delay in processing the results of an applicant's child abuse history certification application.

Purpose of Certification - Do not check more than one box**:**

- Check the **foster parent** box if applying for purposes of providing foster care.
- Check the **prospective adoptive parent** box if applying for the purpose of adoption.
- Check the **employee of child care services** box if applying for the purpose of child care services in the following:
  - Child day care centers; group day care homes; family day care homes; boarding homes for children; juvenile detention center services or programs for delinquent or dependent children; mental health services for children; services for children with intellectual disabilities; early intervention services for children; drug and alcohol services for children; and day care services or other programs that are offered by a school.
- Check the **school employee governed by the Public School Code** box if you are a school employee who is required to obtain background checks pursuant to Section 111 of the Public School Code and will continue to be required to obtain background checks prior to employment in accordance with that section and on the periodic basis required by Act 153.
- Check the **school employee not governed by the Public School Code** box if you are a school employee not governed by Section 111 of the Public School Code, but covered by Act 153 (pertaining to school employees in institutions of higher education).

  Definition of school employee: A school employee is defined as an individual who is employed by a school or who provides a program, activity or service sponsored by a school. The term does not apply to administrative or other support personnel unless they have direct contact with children.

  Definition of school: A facility providing elementary, secondary or postsecondary educational services. The term includes the following:

  (1) Any school of a school district.
  (2) An area vocational-technical school.
  (3) A joint school.
  (4) An intermediate unit.
  (5) A charter school or regional charter school.
  (6) A cyber charter school.
  (7) A private school licensed under the act of January 28, 1988 (P.L.24, No. 11), known as the Private Academic Schools Act.
  (8) A private school accredited by an accrediting association approved by the state Board of Education.
  (9) A non-public school.
  (10) An institution of higher education.
  (11) A private school licensed under the act of December 15, 1986 (P.L. 1585, No. 174), known as the Private Licensed Schools Act.
  (12) The Hiram G. Andrews Center.
  (13) A private residential rehabilitative institution as defined in section 914.1-A(c) of the Public School Code of 1949.
- Check the **self-employed provider of child-care services in a family child-care home** if providing child care services in one's home (other than the child's own home) at any one time to four, five, or six children who are not relatives of the caregiver.
- Check the **individual 14 years of age or older who is applying for or holding a paid position as an employee** box if the employment is with a **program, activity, or service, as a person responsible for the child's welfare or having direct contact with children:** Applying as an employee who is responsible for the child's welfare or having direct contact (providing care, supervision, guidance, or control to children or having routine interaction with children) in any of the following in which children participate and which is sponsored by a school or public or private organization:
  - A youth camp or program;
  - A recreational camp or program;
  - A sports or athletic program;
  - A community or social outreach program;
  - An enrichment or educational program; and
  - A troop, club, or similar organization
- Check the **individual seeking to provide child care services under contract with a child care facility or program** box if you are providing child care services as part of a contract or grant funded program.
- Check the box for **individual 18 years or older who resides in the home of a foster parent for at least 30 days in a calendar year** if you are an adult household member in this setting and require certification.
- Check the box for **individual 18 years or older who resides in the home of a certified or licensed child-care provider for at least 30 days in a calendar year** if you are an adult household member in this setting and require certification.

- Check the box for **individual 18 years or older, excluding individuals receiving services, who resides in a family living home, community home for individuals with an intellectual disability, or host home for children for at least 30 days in a calendar year** if you are an adult household member in this setting and require certification.
- Check the box for **individual 18 years or older who resides in the home of a prospective adoptive parent for at least 30 days in a calendar year** if you are an adult household member in this setting and require certification.
- Check the **volunteer having direct volunteer contact with children** box if applying for the purpose of volunteering as an adult for an unpaid position as a volunteer with a child-care service, a school, or a program, activity or service as a person responsible for the child's welfare or having direct volunteer contact with children. In addition, check the box of one of the organizations listed, i.e. Big Brother/Big Sister, domestic violence shelter, rape crisis center. If you are **NOT** applying for a volunteer in one of the organizations listed, please check the **other** box and write the name of the organization in the space provided.
- Check the **PA Department of Human Services employment & training program participant** box if you are applying for the purpose of participating in a PA Department of Human Services employment and training program through a county assistance office (CAO) or the Office of Income Maintenance (OIM). The signature **AND** phone number of the CAO or OIM representative is required. If there is no signature and no phone number, your application will be rejected and returned to you.
- If you were provided a "**PAYMENT AUTHORIZATION CODE**" by an organization, please provide the **agency/organization name** in the space provided and the **payment authorization code** in the space provided.
- Please check the **CONSENT/RELEASE OF INFORMATION** box if you included a payment code in the space above and attached the completed Consent/Release of Information Authorization form to your Pennsylvania Child Abuse History Certification application when you mail it to our office. The Consent/Release of Information Authorization form allows the department to send your results to a third party. If the Consent/Release of Information Authorization form is **NOT** attached to the certification application, the results **WILL** be mailed to the applicant's home address and not to the third party.

Applicant Demographic Information:

- Name - Include the applicant's full legal name. Initials are not acceptable for a first name. If your full legal name is an initial, please provide supporting documentation along with your certification application.
- Social Security number - Include the applicant's social security number. A social security number is voluntary; **HOWEVER, PLEASE NOTE THAT APPLICATIONS THAT DO NOT INCLUDE SOCIAL SECURITY NUMBERS MAY TAKE LONGER TO BE PROCESSED.**
- Gender - Please check one box.
- Date of birth - Fill in the applicant's date of birth (Example: 01/22/1990).
- Age - Fill in the applicant's current age.

Address:

- The address listed must be the applicant's current home address. This is also where the results of the certification will be mailed, unless otherwise noted. If the **different mailing address** box is checked and a mailing address is provided in the "different" mailing address column, the results will be mailed to the "mailing" address and not the "home" address. **Note:** If the consent/release of information box is checked and an "other" address is provided, the results will be mailed to the "other" address.

Contact Information:

- Please provide your home, work or mobile telephone number. Fill in the number where the applicant can be reached in the event that there are questions about the information on the application.
- Please provide an email address. By providing an email address, you are consenting to ChildLine contacting you by email in the event that you cannot be reached by phone. **NO CONFIDENTIAL INFORMATION WILL EVER BE SHARED OR PROVIDED IN AN EMAIL FROM OUR OFFICE.**

Previous Names Used Since 1975:

- The applicant must list any and all full legal names that they have ever had since 1975. This includes maiden names, nicknames, aliases and also known as (aka) names.

Previous Addresses Since 1975:

- List all addresses where the applicant has resided since 1975. The applicant can attach an additional sheet of paper with all of the addresses listed if necessary. If the applicant cannot remember the exact mailing addresses since 1975, filling in as much information as possible about the location is acceptable.

Household Members:

- Include anyone that the applicant lived with since 1975 (parents, guardians, siblings, children, spouse (ex), paramour, friends, etc.). In addition, include the household member's relationship to the applicant, their age (to the best of your knowledge) and their gender. If the applicant was under the age of 18 in 1975, this section **MUST** include the applicant's PARENT(S) or GUARDIAN(S). If this section is left blank, the application will be rejected and returned to the applicant.

Signature:

- Applications **MUST** be signed and dated. Applications that are not signed and dated will be rejected and returned to the applicant.

CHILDLINE USE ONLY:

- Please DO NOT WRITE in this section. This is for CHILDINE staff only.

Additional Information:

Applicants can visit https://www.compass.state.pa.us/CWIS for more information about submitting the child abuse certification online or to register for a business/organization account.

SP 4-164 (12-2020)

PENNSYLVANIA STATE POLICE

REQUEST FOR CRIMINAL RECORD CHECK

1-888-QUERYPA (1-888-783-7972)

This form is to be completed in ink by the requester – (information will be mailed to the requester only). If this form is not legible or not properly completed, it will be returned unprocessed to the requester.

TRY OUR WEBSITE FOR A QUICKER RESPONSE
https://epatch.state.pa.us

REQUESTER NAME	
ADDRESS	
CITY/STATE/ ZIP CODE	
TELEPHONE NO. (AREA CODE)	

FOR CENTRAL REPOSITORY USE ONLY
CONTROL NUMBER

AFTER COMPLETION MAIL TO:

PENNSYLVANIA STATE POLICE
CENTRAL REPOSITORY – 164
1800 ELMERTON AVENUE
HARRISBURG, PA 17110-9758

DO NOT SEND CASH OR PERSONAL CHECK

CHECK ONE BLOCK

◯ **INDIVIDUAL/NONCRIMINAL JUSTICE AGENCY – ENCLOSE A CERTIFIED CHECK/MONEY ORDER IN THE AMOUNT OF $22.00, PAYABLE TO: "*COMMONWEALTH OF PENNSYLVANIA*" THE FEE IS NONREFUNDABLE**

◯ **NOTARIZED INDIVIDUAL/NONCRIMINAL JUSTICE AGENCY – ENCLOSE A CERTIFIED CHECK/MONEY ORDER IN THE AMOUNT OF $27.00, PAYABLE TO: "*COMMONWEALTH OF PENNSYLVANIA*" THE FEE IS NONREFUNDABLE**

◯ **FEE EXEMPT-NONCRIMINAL JUSTICE AGENCY – NO FEE**

SUBJECT OF RECORD CHECK

(FIRST)	(MIDDLE)	(LAST)		
MAIDEN NAME AND/OR ALIASES	**SOCIAL SECURITY NUMBER**	**DATE OF BIRTH (MM/DD/YYYY)**	**SEX**	**RACE**
			Select	Select

The Pennsylvania State Police response will be based on the comparison of the data provided by the requester against the information *contained in the files of the Pennsylvania State Police Central Repository only.*

FEES FOR REQUESTS - $22.00. NOTARIZED FEE REQUESTS - $27.00.
******MAKE ALL MONEY ORDERS PAYABLE TO: COMMONWEALTH OF PENNSYLVANIA ******

REASON FOR REQUEST

◄◄◄◄◄◄CHECK THE BOX THAT MOST APPLIES TO THE PURPOSE OF THIS REQUEST►►►►►►

◯ **INTERNATIONAL ADOPTION - INTERNATIONAL ADOPTION MUST BE NOTARIZED AND MAILED IN. ($27.00 FOR REQUEST)**

◯ **ADOPTION (DOMESTIC)** ◯ **EMPLOYMENT** ◯ **VISA** ◯ **OTHER**

WARNING: 18 Pa.C.S. 4904(b) UNDER PENALTY OF LAW - MISIDENTIFICATION OR FALSE STATEMENTS OF IDENTITY TO OBTAIN CRIMINAL HISTORY INFORMATION OF ANOTHER IS PUNISHABLE AS AUTHORIZED BY LAW.

Homeland Security is Everyone's Responsibility - Pennsylvania Terrorism Tip Line 1-888-292-1919

ARREST/CONVICTION REPORT AND CERTIFICATION FORM
(under Act 24 of 2011 and Act 82 of 2012)

Section 1. Personal Information

Full Legal Name: _____

Date of Birth: _____/_____/_____

Other names by which you have been identified: _____

Section 2. Arrest or Conviction

☐ By checking this box, I state that I have NOT been arrested for or convicted of any Reportable Offense.

☐ By checking this box, I report that I have been arrested for or convicted of an offense or offenses enumerated under 24 P.S. §§1-111(e) or (f.1) ("Reportable Offense(s)"). See Page 3 of this Form for a list of Reportable Offenses.

Details of Arrests or Convictions

For each arrest for or conviction of any Reportable Offense, specify in the space below (or on additional attachments if necessary) the offense for which you have been arrested or convicted, the date and location of arrest and/or conviction, docket number, and the applicable court.

_____

_____

Section 3. Child Abuse

☐ By checking this box, I state that I have NOT been named as a perpetrator of a founded report of child abuse within the past five (5) years as defined by the Child Protective Services Law.

☐ By checking this box, I report that I have been named as a perpetrator of a founded report of child abuse within the past five (5) years as defined by the Child Protective Services Law.

Section 4. Certification

By signing this form, I certify under penalty of law that the statements made in this form are true, correct and complete. I understand that false statements herein, including, without limitation, any failure to accurately report any arrest or conviction for a Reportable Offense, shall subject me to criminal prosecution under 18 Pa.C.S. §4904, relating to unsworn falsification to authorities.

_____

Signature *Date*

INSTRUCTIONS

Pursuant to 24 P.S. §1-111(c.4) and (j), the Pennsylvania Department of Education developed this standardized form (PDE-6004) to be used by current and prospective employees of public and private schools, intermediate units, and area vocational-technical schools.

As required by subsection (c.4) and (j)(2) of 24 P.S. §1-111, this form shall be completed and submitted by all current and prospective employees of said institutions to provide written reporting of any arrest or conviction for an offense enumerated under 24 P.S. §§1-111(e) and (f.1) and to provide notification of having been named as a perpetrator of a founded report of child abuse within the past five (5) years as defined by the Child Protective Services Law.

As required by subsection (j)(4) of 24 P.S. §1-111, this form also shall be utilized by current and prospective employees to provide written notice within seventy-two (72) hours after a subsequent arrest or conviction for an offense enumerated under 24 P.S. §§1-111(e) or (f.1).

In accordance with 24 P.S. §1-111, employees completing this form are required to submit the form to the administrator or other person responsible for employment decisions in a school entity. Please contact a supervisor or the school entity administration office with any questions regarding the PDE 6004, including to whom the form should be sent.

PROVIDE ALL INFORMATION REQUIRED BY THIS FORM LEGIBLY IN INK.

LIST OF REPORTABLE OFFENSES

- **A reportable offense enumerated under 24 P.S. §1-111(e) consists of any of the following:**

(1) An offense under one or more of the following provisions of Title 18 of the Pennsylvania Consolidated Statutes:

- Chapter 25 (relating to criminal homicide)
- Section 2702 (relating to aggravated assault)
- Section 2709.1 (relating to stalking)
- Section 2901 (relating to kidnapping)
- Section 2902 (relating to unlawful restraint)
- Section 2910 (relating to luring a child into a motor vehicle or structure)
- Section 3121 (relating to rape)
- Section 3122.1 (relating to statutory sexual assault)
- Section 3123 (relating to involuntary deviate sexual intercourse)
- Section 3124.1 (relating to sexual assault)
- Section 3124.2 (relating to institutional sexual assault)
- Section 3125(relating to aggravated indecent assault)
- Section 3126 (relating to indecent assault)
- Section 3127 (relating to indecent exposure)
- Section 3129 (relating to sexual intercourse with animal)
- Section 4302 (relating to incest)
- Section 4303 (relating to concealing death of child)
- Section 4304 (relating to endangering welfare of children)
- Section 4305 (relating to dealing in infant children)
- A felony offense under section 5902(b) (relating to prostitution and related offenses)
- Section 5903(c) or (d) (relating to obscene and other sexual materials and performances)
- Section 6301(a)(1) (relating to corruption of minors)
- Section 6312 (relating to sexual abuse of children)
- Section 6318 (relating to unlawful contact with minor)
- Section 6319 (relating to solicitation of minors to traffic drugs)
- Section 6320 (relating to sexual exploitation of children)

(2) An offense designated as a felony under the act of April 14, 1972 (P.L. 233, No. 64), known as "The Controlled Substance, Drug, Device and Cosmetic Act."

(3) An offense SIMILAR IN NATURE to those crimes listed above in clauses (1) and (2) under the laws or former laws of:

- the United States; or
- one of its territories or possessions; or
- another state; or
- the District of Columbia; or
- the Commonwealth of Puerto Rico; or
- a foreign nation; or
- under a former law of this Commonwealth.

- **A reportable offense enumerated under 24 P.S. §1-111(f.1) consists of any of the following:**

(1) An offense graded as a felony offense of the first, second or third degree, other than one of the offenses enumerated under 24 P.S. §1-111(e), if less than (10) ten years has elapsed from the date of expiration of the sentence for the offense.

(2) An offense graded as a misdemeanor of the first degree, other than one of the offenses enumerated under 24 P.S. §1-111(e), if less than (5) five years has elapsed from the date of expiration of the sentence for the offense.

(3) An offense under *75 Pa.C.S. § 3802(a)*, (b), (c) or (d)(relating to driving under influence of alcohol or controlled substance) graded as a misdemeanor of the first degree under *75 Pa.C.S. § 3803* (relating to grading), if the person has been previously convicted of such an offense and less than (3) three years has elapsed from the date of expiration of the sentence for the most recent offense.

COMMONWEALTH OF PENNSYLVANIA
SEXUAL MISCONDUCT/ABUSE DISCLOSURE RELEASE
(Pursuant to Act 168 of 2014)

Instructions

This standardized form has been developed by the Pennsylvania Department of Education, pursuant to Act 168 of 2014, to be used by school entities and independent contractors of school entities and by applicants who would be employed by or in a school entity in a position involving direct contact with children to satisfy the Act's requirement of providing information related to abuse or sexual misconduct. As required by Act 168, in addition to fulfilling the requirements under section 111 of the School Code and the Child Protective Services Law ("CPSL"), an applicant who would be employed by or in a school entity in a position having direct contact with children, must provide the information requested in SECTION 1 of this form and complete a written authorization that consents to and authorizes the disclosure by the applicant's current and former employers of the information requested in SECTION 2 of this form. The applicant shall complete one form for the applicant's current employer(s) and one for each of the applicant's former employers that were school entities or where the applicant was employed in a position having direct contact with children (therefore, the applicant may have to complete more than one form). Upon completion by the applicant, the hiring school entity or independent contractor shall submit the form to the applicant's current and former employers to complete SECTION 2. **A school entity or independent contractor may not hire an applicant who does not provide the required information for a position involving direct contact with children.**

Relevant Definitions:

Direct Contact with Children is defined as: "the possibility of care, supervision, guidance or control of children or routine interaction with children."

Sexual Misconduct is defined as: "any act, including, but not limited to, any verbal, nonverbal, written or electronic communication or physical activity, directed toward or with a child or a student regardless of the age of the child or student that is designated to establish a romantic or sexual relationship with the child or student. Such acts include, but are not limited to: (1) sexual or romantic invitation; (2) dating or soliciting dates; (3) engaging in sexualized or romantic dialogue; (4) making sexually suggestive comments; (5) self-disclosure or physical exposure of a sexual, romantic or erotic nature; or (6) any sexual, indecent, romantic or erotic contact with the child or student."

Abuse is defined as "conduct that falls under the purview and reporting requirements of the CPSL, 23 Pa.C.S. Ch. 63, is directed toward or against a child or a student, regardless of the age of the child or student."

Please Note

A prospective employer that receives any requested information regarding an applicant may use the information for the purpose of evaluating the applicant's fitness to be hired or for continued employment and shall report the information as appropriate to the Department of Education, a state licensing agency, law enforcement agency, child protective services agency, another school entity or to a prospective employer.

If the prospective employer decides to further consider an applicant after receiving an affirmative response to any of the questions listed in SECTIONS 1 and 2 of this form, the prospective employer shall request that former employers responding affirmatively to the questions provide additional information about the matters disclosed and include any related records. The **Commonwealth of Pennsylvania Sexual Misconduct/Abuse Disclosure Information Request** can be used to request this follow-up information. Former employers shall provide the additional information and records within 60 calendar days of the prospective employer's request.

The completed form and any information or records received shall not be considered public records for the purposes of the Act of February 14, 2008 (P.L. 6, No. 3) known as the "Right to Know Law."

The Department of Education shall have jurisdiction to determine willful violations of Act 168 and may, following a hearing, assess a civil penalty not to exceed $10,000. School entities shall be barred from entering into a contract with an independent contractor who is found to have willfully violated the provisions of Act 168.

COMMONWEALTH OF PENNSYLVANIA
SEXUAL MISCONDUCT/ABUSE DISCLOSURE RELEASE
(under Act 168 of 2014)

(Hiring school entity or independent contractor submits this form to ALL current employer(s) and to former employer(s) that were school entities and/or where the applicant had direct contact with children)

To:

Name of Current or Former Employer:		☐ No applicable employment
Street Address:		
City, State, Zip:		
Telephone Number:	Fax Number:	Email:
Contact Person:		Title:

The named applicant is under consideration for a position with our entity. The Pennsylvania General Assembly has determined that additional safeguards are necessary in the hiring of school employees to ensure the safety of the Commonwealth's students. The individual whose name appears below has reported previous employment with your entity. We request you provide the information requested in SECTION 2 of this form within **20 calendar days** as required by Act 168 of 2014.

SECTION 1: APPLICANT CERTIFICATION AND RELEASE (TO BE COMPLETED BY THE APPLICANT EVEN IF THE APPLICANT HAS NO CURRENT OR PRIOR EMPLOYMENT TO DISCLOSE)

Applicant's Name (First, Middle, Last):	
Any former names by which the Applicant has been identified:	
DOB:	
Last 4 digits of Applicant's Social Security Number:	PPID (if applicable):
Approximate dates of employment with the entity listed above:	
Position(s) held with the entity:	

Pursuant to Act 168, an employer, school entity, administrator, and/or independent contractor that provides information or records about a current or former employee or applicant shall be immune from criminal liability under the CPSL, the Educator Discipline Act, and from civil liability for the disclosure of the information, unless the information or records provided were knowingly false. Such immunity shall be in addition to and not in limitation of any other immunity provided by law or any absolute or conditional privileges applicable to such disclosure by the virtue of the circumstances of the applicant's consent thereto. Under Act 168, the willful failure to respond to or provide the information and records as requested may result in civil penalties and/or professional discipline, where applicable.

Have you (Applicant) ever:

Yes ◯ No ◯ Been the subject of an abuse or sexual misconduct investigation by any employer, state licensing agency, law enforcement agency or child protective services agency (unless the investigation resulted in a finding that the allegations were false)?

Yes ◯ No ◯ Been disciplined, discharged, non-renewed, asked to resign from employment, resigned from or otherwise separated from employment while allegations of abuse or sexual misconduct were pending or under investigation or due to adjudication or findings of abuse or sexual misconduct?

Yes ◯ No ◯ Had a license, professional license or certificate suspended, surrendered or revoked while allegations of abuse or sexual misconduct were pending or under investigation or due to an adjudication or findings of abuse or sexual misconduct?

By signing this form, I certify under penalty of law that the statements made in this form are correct, complete, and true to the best of my knowledge. I understand that false statements herein, including, without limitation, any willful failure to disclose the information required, shall subject me to criminal prosecution under 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) and to discipline up to, and including, termination or denial of employment, and may subject me to civil penalties and disciplinary action under the Educator Discipline Act. I also hereby authorize the above-named employer to release to the entity listed on page 3, the information requested in SECTION 2 of this form and any related records. I hereby release, waive, and discharge the above-named employer from any and all liability of any kind that may arise from such disclosure or release of records. I understand that third party vendors may be used to process this Act 168 pre-employment history review.

_____ _____

Signature of Applicant Date

SECTION 2: CURRENT/FORMER EMPLOYER VERIFICATION (TO BE COMPLETED BY THE APPLICANT'S CURRENT EMPLOYER(S) AND ALL FORMER EMPLOYERS THAT WERE SCHOOL ENTITIES AND/OR WHERE THE APPLICANT HAD DIRECT CONTACT WITH CHILDREN)

Dates of employment of Applicant: _____ Contact telephone #:_____

To the best of your knowledge, has Applicant ever:

Yes ◯ No ◯ Been the subject of an abuse or sexual misconduct investigation by any employer, state licensing agency, law enforcement agency or child protective services agency (unless the investigation resulted in a finding that the allegations were false)?

Yes ◯ No ◯ Been disciplined, discharged, non-renewed, asked to resign from employment, resigned from or otherwise separated from employment while allegations of abuse or sexual misconduct were pending or under investigation or due to adjudication or findings of abuse or sexual misconduct?

Yes ◯ No ◯ Had a license, professional license or certificate suspended, surrendered or revoked while allegations of abuse or sexual misconduct were pending or under investigation or due to an adjudication or findings of abuse or sexual misconduct?

☐ No records or other evidence currently exists regarding the above questions. I have no knowledge of information pertaining to the applicant that would disqualify the applicant from employment.

_____ _____

Former Employer Representative Signature and Title Date

Return all completed information to:

School Entity/Independent Contractor:	
Address:	Phone:
City: State: Zip:	Fax: Email:
Contact Person:	Title:

Date Form Received: _____ Received by: _____

SECTION 00 31 00 – AVAILABLE PROJECT INFORMATION – EXISTING DRAWINGS

A. All Prime Bidders will receive the below listed items as part of the Bidding Documents. The below listed items can be found in a separate file on Procore.

   1. The following drawing set(s) of the Jarrettown Elementary School are being included as part of the Bidding Documents for reference only:

      a. Jarrettown Elementary School Addition and Renovation Drawings dated January 12, 1993, 74 Drawings.

B. Bidder shall determine the adequacy of the attached drawings for use in preparing their Bid for the Work. Bidders should visit the site to familiarize themselves with existing conditions. No claims will be honored for inadequacy of data. Should Bidder determine that additional information is required, the Bidder shall make, prior to bidding, his own exploration, tests, and analyses.
C. Existing drawings that have been made available to Bidders shall not constitute a Contract Document and shall be considered as “general information” only. The Existing Drawings set is not a representation or guarantee of the continuity of any condition. The Owner, Construction Manager, or Architect will not be responsible for interpretations or conclusions drawn from the existing drawings by the Bidder. The Owner, Construction Manager, and Architect are not responsible for the accuracy or completeness of the information given in the existing drawings.
D. Contact ICS, Construction Manager (CM), Ryan Murphy at 610-368-2373 to schedule site visits for further evaluation of existing conditions. Bidders shall provide insurance certificates as per General Conditions Article 11 and other information required prior to performing additional exploration or tests.

END OF SECTION 00 31 00

SECTION 00 41 16 – BID FORM - WORK SCOPE NO.1 - GENERAL CONSTRUCTION

BID TO: UPPER DUBLIN SCHOOL DISTRICT
1580 FORT WASHINGTON AVE., MAPLE GLEN, PA 19002

BID FROM: _____

_____

_____

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 proposed and agrees, if written notice of the acceptance of this Bid is received by the undersigned within 60 days after date set for opening of this Bid, or at any other time thereafter before Bid is withdrawn, the undersigned agrees to enter into and execute a Contract with the Owner in accordance with this Bid as accepted. This shall be in a form acceptable to Owner, and the successful Bidder shall furnish and deliver to Owner the Performance Bond and Labor and Material Payment Bond in the forms provided in the Bidding Documents, and proof of insurance coverage, all within ten (10) days after notice of acceptance of this Bid.

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 60 days after the day of Bid Opening unless the OWNER is delayed in awarding the Contract due to the failure to receive a required approval/permit from one or more reviewing bodies/governmental agencies having jurisdiction over the Project, the sale of bonds or the award of a Grant, in which case, Bids shall be irrevocable for 120 days. BIDDER will sign the Agreement and submit the required bonds 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 certified that it has examined copies of all Contract Documents. Bidder has made a thorough inspection of the premises and that the equipment and the construction activities that form the basis of this agreement can be completed in a good and workman-like manner for the amount of its Bid. Further, Bidder certifies that all of the equipment, installation, and construction activities to be supplied pursuant to this Bid and an agreement with Owner, if awarded. Bidder has reported any discrepancies, duplications, errors, or omissions in the Contract Documents, as required in the Contract Documents and hereby waives any claims for additional cost or time for such matters that were apparent or discoverable by Bidder from a thorough and complete review of the Contract Documents prior to submission of this Bid. Additionally, the Bidder hereby acknowledges receipt of the following addenda:

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

b. The Undersigned here certifies that this Bid is genuine and not a sham, collusive or fraudulent or made in the interest of or in behalf of any person, firm or corporation not herein named; and that the Undersigned has not, directly or indirectly, inducted or solicited any bidder to submit a sham bid, or any other person, firm or corporation from bidding, and that the Undersigned has not, in any manner, sought by collusion to secure for himself any advantage over any other Bidder.

c. In accordance with the Advertisement for Bids and the proposed Construction Documents distributed by ICS, 1400 N. Providence Rd, Building 2, Suite 4045, Media, PA 19063, dated October 29th, 2026, relating to Work Scope No. 1, General Construction, for Work generally described as the New Jarrettown Elementary School Project, the undersigned, having visited the site of proposed construction and having become thoroughly familiar with local conditions affecting the cost and performance of the work and with all requirements of the Contract Documents and related Addenda, hereby proposes and agrees to provide all labor, materials and equipment required to construct and complete the Work in accordance with the Contract Documents and Addenda for the following amounts:

4. Base Bid:

Work Scope #1 Base Bid Price (INCLUDING Project Allowances) for all Work indicated on the Contract Documents for Work Scope No. 1, General Construction:

_____ Dollars.
(Written Amount)

($_____)
(Numerical Amount)

5. Alternates:

Reference Section 01 23 00, Alternates, for the full description of the included Project Alternates for this Work Scope. Do not adjust material allowances under any alternate bid items. Indicate whether alternate cost is an add or deduct when a choice is provided.

Alternate No. 1 Reduced Gym Size, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 2 Reduction of Main Entry Canopy, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 3A Install quartz tile in lieu of terrazzo throughout first and second floors, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 3B Install quartz tile in lieu of terrazzo throughout the second floor only, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 3C Install SVT in lieu of terrazzo throughout the second floor, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 4 Remove upper cabinets in the classrooms where indicated, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 5 Remove tack panels above marker board in classrooms where indicated, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 6A Add both sets of bleachers in gymnasium (base bid layout), as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 6B Add 1 set of bleachers in gymnasium (base bid layout, southern bleacher), as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 6C Add both sets of bleachers in gymnasium (alternate layout), as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 6D Add 1 set of bleachers in gymnasium (alternate layout, southern bleacher), as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 7 Mechanical Courtyard, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 8 ADD – Unclassified Rock Excavation, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 9 ADD – Provide engineered structural fill or 2A modified stone 24" deep in lieu of onsite materials for all building pad fills, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 10 ADD – Provide sod up to 5' outside of the building footprint, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 11 ADD – Replace the base bid mechanical system with a Geothermal well mechanical system as indicated in the project drawings, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

6. Unit Prices:

The Bidder is required to bid unit prices on the following items as identified in Section 01 22 00 – Unit Prices and Material Allowances in accordance with the Contract Documents. 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 to 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 and the Material Allowance extension shall be recalculated.

If any extra work is required in these categories beyond the contract requirements, the unit prices shall be used as a basis for determining the amount of additional payment to the Contractor. The Bidder agrees that Owner reserves the right to reject or otherwise not agree to use the Unit Prices submitted, if in the Owner's opinion, the nature or quantity of the Work encountered is such that the Unit Price cost no longer applies to the Work. The Owner also reserves the right to solicit independent proposals as required by the Department of Education guidelines, under a separate contract, to perform the services required. **The responsiveness of the Bid 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 Bid 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.** The Construction Manager 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 deduction.

The contract Unit Price per (UOM) for Unit Price WS-1A as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1B as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1C as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1D as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1E as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1F as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1G as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1H as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1I as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1J as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1K as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1L as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1M as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1N as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1O as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1P as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1Q as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1R as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1S as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1T as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1U as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1V as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1W as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1X as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1Y as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-1Z as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

(REMAINDER OF PAGE INTENTIONALLY LEFT BLANK)

In witness whereof, the undersigned has caused this Proposal to be executed this _____day of _____ 20_____.

Name of Contractor: _____

State of Incorporation for Contractor: _____

Contractor (Entity) Type: _____

Street Address: _____

City: _____State: _____Zip: _____

Phone Number: _____Fax Number: _____

Name of Representative: _____

Title of Representative: _____

Signature of Representative: _____

Date of Signature: _____

Name of Witness: _____

Signature of Witness: _____

Date of Signature: _____

END OF SECTION 00 41 16

SECTION 00 41 17 – BID FORM - WORK SCOPE NO. 2 - ELECTRICAL CONSTRUCTION

BID TO: UPPER DUBLIN SCHOOL DISTRICT
1580 FORT WASHINGTON AVE., MAPLE GLEN, PA 19002

BID FROM: _____

_____

_____

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 proposed and agrees, If written notice of the acceptance of this Bid is received by the undersigned within 60 days after date set for opening of this Bid, or at any other time thereafter before Bid is withdrawn, the undersigned agrees to enter into and execute a Contract with the Owner in accordance with this Bid as accepted. This shall be in a form acceptable to Owner, and the successful Bidder shall furnish and deliver to Owner the Performance Bond and Labor and Material Payment Bond, in the forms provided in the Bidding Documents, and proof of insurance coverage, all within ten (10) days after notice of acceptance of this Bid.

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 60 days after the day of Bid Opening unless the OWNER is delayed in awarding the Contract due to the failure to receive a required approval/permit from one or more reviewing bodies/governmental agencies having jurisdiction over the Project, the sale of bonds or the award of a Grant, in which case, Bids shall be irrevocable for 120 days. BIDDER will sign the Agreement and submit the required bonds 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 certified that it has examined copies of all Contract Documents. Bidder has made a thorough inspection of the premises and that the equipment and the construction activities that form the basis of this agreement can be completed in a good and workman-like manner for the amount of its Bid. Further, Bidder certifies that all of the equipment, installation, and construction activities to be supplied pursuant to this Bid and an agreement with Owner, if awarded. Bidder has reported any discrepancies, duplications, errors, or omissions in the Contract Documents, as required in the Contract Documents and hereby waives any claims for additional cost or time for such matters that were apparent or discoverable by Bidder from a thorough and complete review of the Contract Documents prior to submission of this Bid. Additionally, the Bidder hereby acknowledges receipt of the following addenda:

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

b. The Undersigned here certifies that this Bid is genuine and not a sham, collusive or fraudulent or made in the interest of or in behalf of any person, firm or corporation not herein named; and that the Undersigned has not, directly or indirectly, inducted or solicited any bidder to submit a sham bid, or any other person, firm or corporation from bidding, and that the Undersigned has not, in any manner, sought by collusion to secure for himself any advantage over any other Bidder.

c. In accordance with the Advertisement for Bids and the proposed Construction Documents distributed by ICS, 1400 N. Providence Rd, Building 2, Suite 4045, Media, PA 19063, dated October 29th, 2026, relating to Work Scope No. 2, Electrical Construction, for Work generally described as the New Jarrettown Elementary School Project, the undersigned, having visited the site of proposed construction and having become thoroughly familiar with local conditions affecting the cost and performance of the work and with all requirements of the Contract Documents and related Addenda, hereby proposes and agrees to provide all labor, materials and equipment required to construct and complete the Work in accordance with the Contract Documents and Addenda for the following amounts:

4. Base Bid:

Work Scope #2 Base Bid Price (INCLUDING Project Allowances) for all Work indicated on the Contract Documents for Work Scope No. 2, Electrical Construction:

_____ Dollars.
(Written Amount)

($_____)
(Numerical Amount)

5. Alternates:

Reference Section 01 23 00, Alternates, for the full description of included Project Alternates for this Work Scope. Do not adjust material allowances under any alternate bid items. Indicate whether alternate cost is an add or deduct when a choice is provided.

Alternate No. 1 Reduced Gym Size, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 2 ADD – Replace the base bid mechanical system with a Geothermal well mechanical system as indicated in the project drawings, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

6. Unit Prices:

The Bidder is required to bid unit prices on the following items as identified in Section 01 22 00 – Unit Prices and Material Allowances in accordance with the Contract Documents. 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 to 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 and the Material Allowance extension shall be recalculated.

If any extra work is required in these categories beyond the contract requirements, the unit prices shall be used as a basis for determining the amount of additional payment to the Contractor. The Bidder agrees that Owner reserves the right to reject or otherwise not agree to use the Unit Prices submitted, if in the Owner's opinion, the nature or quantity of the Work encountered is such that the Unit Price cost no longer applies to the Work. The Owner also reserves the right to solicit independent proposals as required by the Department of Education guidelines, under a separate contract, to perform the services required. **The responsiveness of the Bid 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 Bid 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.** The Construction Manager 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 deduction.

The contract Unit Price per (UOM) for Unit Price WS-2A as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2B as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2C as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2D as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2E as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2F as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2G as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2H as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2I as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2J as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2K as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2L as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-2M as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

(REMAINDER OF PAGE INTENTIONALLY LEFT BLANK)

In witness whereof, the undersigned has caused this Proposal to be executed this _____day of _____ 20_____.

Name of Contractor: _____

State of Incorporation for Contractor: _____

Contractor (Entity) Type: _____

Street Address: _____

City: _____State: _____Zip: _____

Phone Number: _____Fax Number: _____

Name of Representative: _____

Title of Representative: _____

Signature of Representative: _____

Date of Signature: _____

Name of Witness: _____

Signature of Witness: _____

Date of Signature: _____

END OF SECTION 00 41 17

SECTION 00 41 18 – BID FORM - WORK SCOPE NO. 3 - MECHANICAL CONSTRUCTION

BID TO: UPPER DUBLIN SCHOOL DISTRICT
1580 FORT WASHINGTON AVE., MAPLE GLEN, PA 19002

BID FROM: _____

_____

_____

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 proposed and agrees, if written notice of the acceptance of this Bid is received by the undersigned within 60 days after date set for opening of this Bid, or at any other time thereafter before Bid is withdrawn, the undersigned agrees to enter into and execute a Contract with the Owner in accordance with this Bid as accepted. This shall be in a form acceptable to Owner, and the successful Bidder shall furnish and deliver to Owner the Performance Bond and Labor and Material Payment Bond in the forms provided in the Bidding Documents, and proof of insurance coverage, all within ten (10) days after notice of acceptance of this Bid.

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 60 days after the day of Bid Opening unless the OWNER is delayed in awarding the Contract due to the failure to receive a required approval/permit from one or more reviewing bodies/governmental agencies having jurisdiction over the Project, the sale of bonds or the award of a Grant, in which case, Bids shall be irrevocable for 120 days. BIDDER will sign the Agreement and submit the required bonds 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 certified that it has examined copies of all Contract Documents. Bidder has made a thorough inspection of the premises and that the equipment and the construction activities that form the basis of this agreement can be completed in a good and workman-like manner for the amount of its Bid. Further, Bidder certifies that all of the equipment, installation, and construction activities to be supplied pursuant to this Bid and an agreement with Owner, if awarded. Bidder has reported any discrepancies, duplications, errors, or omissions in the Contract Documents, as required in the Contract Documents and hereby waives any claims for additional cost or time for such matters that were apparent or discoverable by Bidder from a thorough and complete review of the Contract Documents prior to submission of this Bid. Additionally, the Bidder hereby acknowledges receipt of the following addenda:

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

b. The Undersigned here certifies that this Bid is genuine and not a sham, collusive or fraudulent or made in the interest of or in behalf of any person, firm or corporation not herein named; and that the Undersigned has not, directly or indirectly, inducted or solicited any bidder to submit a sham bid, or any other person, firm or corporation from bidding, and that the Undersigned has not, in any manner, sought by collusion to secure for himself any advantage over any other Bidder.

c. In accordance with the Advertisement for Bids and the proposed Construction Documents distributed by ICS, 1400 N. Providence Rd, Building 2, Suite 4045, Media, PA 19063, dated October 29th, 2026, relating to Work Scope No. 3, Mechanical Construction, for Work generally described as the New Jarrettown Elementary School Project, the undersigned, having visited the site of proposed construction and having become thoroughly familiar with local conditions affecting the cost and performance of the work and with all requirements of the Contract Documents and related Addenda, hereby proposes and agrees to provide all labor, materials and equipment required to construct and complete the Work in accordance with the Contract Documents and Addenda for the following amounts:

4. Base Bid:

Work Scope #3 Base Bid Price (INCLUDING Project Allowances) for all Work indicated on the Contract Documents for Work Scope No. 3, Mechanical Construction:

_____ Dollars.
(Written Amount)

($_____)
(Numerical Amount)

5. Alternates:

Reference Section 01 23 00, Alternates, for the full description of included Project Alternates for this Work Scope. Do not adjust material allowances under any alternate bid items. Indicate whether alternate cost is an add or deduct when a choice is provided.

Alternate No. 1 Reduced Gym Size, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 2 ADD – Replace the base bid mechanical system with a Geothermal well mechanical system as indicated in the project drawings, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 3 Allow for HDPE, PVC, or CPVC in lieu of Copper/Steel, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

6. Unit Prices:

The Bidder is required to bid unit prices on the following items as identified in Section 01 22 00 – Unit Prices and Material Allowances in accordance with the Contract Documents. 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 to 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 and the Material Allowance extension shall be recalculated.

If any extra work is required in these categories beyond the contract requirements, the unit prices shall be used as a basis for determining the amount of additional payment to the

Contractor. The Bidder agrees that Owner reserves the right to reject or otherwise not agree to use the Unit Prices submitted, if in the Owner's opinion, the nature or quantity of the Work encountered is such that the Unit Price cost no longer applies to the Work. The Owner also reserves the right to solicit independent proposals as required by the Department of Education guidelines, under a separate contract, to perform the services required. **The responsiveness of the Bid 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 Bid 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.** The Construction Manager 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 deduction.

The contract Unit Price per (UOM) for Unit Price WS-3A as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-3B as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-3C as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-3D as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-3E as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-3F as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-3G as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-3H as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-3I as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-3J as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-3K as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

(REMAINDER OF PAGE INTENTIONALLY LEFT BLANK)

In witness whereof, the undersigned has caused this Proposal to be executed this _____day of _____ 20_____.

Name of Contractor: _____

State of Incorporation for Contractor: _____

Contractor (Entity) Type: _____

Street Address: _____

City: _____State: _____Zip: _____

Phone Number: _____Fax Number: _____

Name of Representative: _____

Title of Representative: _____

Signature of Representative: _____

Date of Signature: _____

Name of Witness: _____

Signature of Witness: _____

Date of Signature: _____

END OF SECTION 00 41 18

SECTION 00 41 19 – BID FORM - WORK SCOPE NO. 4 – PLUMBING/FIRE PROTECTION CONSTRUCTION

BID TO: UPPER DUBLIN SCHOOL DISTRICT
1580 FORT WASHINGTON AVE., MAPLE GLEN, PA 19002

BID FROM: _____

_____

_____

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 proposed and agrees, if written notice of the acceptance of this Bid is received by the undersigned within 60 days after date set for opening of this Bid, or at any other time thereafter before Bid is withdrawn, the undersigned agrees to enter into and execute a Contract with the Owner in accordance with this Bid as accepted. This shall be in a form acceptable to Owner, and the successful Bidder shall furnish and deliver to Owner the Performance Bond and Labor and Material Payment Bond in the forms provided in the Bidding Documents, and proof of insurance coverage, all within ten (10) days after notice of acceptance of this Bid.

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 60 days after the day of Bid Opening unless the OWNER is delayed in awarding the Contract due to the failure to receive a required approval/permit from one or more reviewing bodies/governmental agencies having jurisdiction over the Project, the sale of bonds or the award of a Grant, in which case, Bids shall be irrevocable for 120 days. BIDDER will sign the Agreement and submit the required bonds 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 certified that it has examined copies of all Contract Documents. Bidder has made a thorough inspection of the premises and that the equipment and the construction activities that form the basis of this agreement can be completed in a good and workman-like manner for the amount of its Bid. Further, Bidder certifies that all of the equipment, installation, and construction activities to be supplied pursuant to this Bid and an agreement with Owner, if awarded. Bidder has reported any discrepancies, duplications, errors, or omissions in the Contract Documents, as required in the Contract Documents and hereby waives any claims for additional cost or time for such matters that were apparent or discoverable by Bidder from a thorough and complete review of the Contract Documents prior to submission of this Bid. Additionally, the Bidder hereby acknowledges receipt of the following addenda:

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

Addenda No. _____ Dated _____

b. The Undersigned here certifies that this Bid is genuine and not a sham, collusive or fraudulent or made in the interest of or in behalf of any person, firm or corporation not herein named; and that the Undersigned has not, directly or indirectly, inducted or solicited any bidder to submit a sham bid, or any other person, firm or corporation from bidding, and that the Undersigned has not, in any manner, sought by collusion to secure for himself any advantage over any other Bidder.

c. In accordance with the Advertisement for Bids and the proposed Construction Documents distributed by ICS, 1400 N. Providence Rd, Building 2, Suite 4045, Media, PA 19063, dated October 29th, 2026, relating to Work Scope No. 4, Plumbing/Fire Protection Construction, for Work generally described as the New Jarrettown Elementary School Project, the undersigned, having visited the site of proposed construction and having become thoroughly familiar with local conditions affecting the cost and performance of the work and with all requirements of the Contract Documents and related Addenda, hereby proposes and agrees to provide all labor, materials and equipment required to construct and complete the Work in accordance with the Contract Documents and Addenda for the following amounts:

4. Base Bid:

Work Scope #4 Base Bid Price (INCLUDING Project Allowances) for all Work indicated on the Contract Documents for Work Scope No. 4, Plumbing/Fire Protection Construction:

_____ Dollars.
(Written Amount)

($_____)
(Numerical Amount)

5. Alternates:

Reference Section 01 23 00, Alternates, for the full description of included Project Alternates for this Work Scope. Do not adjust material allowances under any alternate bid items. Indicate whether alternate cost is an add or deduct when a choice is provided.

Alternate No. 1 Reduced Gym Size, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 2 ADD – Replace the base bid mechanical system with a Geothermal well mechanical system as indicated in the project drawings, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

Alternate No. 3 Allow for HDPE, PVC, or CPVC in lieu of Copper/Steel, as described in Specification Section 01 23 00 Alternates.

(Add, Deduct, No Change) $_____.
(Circle One) *(Numerical Amount)*

_____Dollars.
(Written Amount)

6. Unit Prices:

The Bidder is required to bid unit prices on the following items as identified in Section 01 22 00 – Unit Prices and Material Allowances in accordance with the Contract Documents. 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 to 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 and the Material Allowance extension shall be recalculated.

If any extra work is required in these categories beyond the contract requirements, the unit prices shall be used as a basis for determining the amount of additional payment to the

Contractor. The Bidder agrees that Owner reserves the right to reject or otherwise not agree to use the Unit Prices submitted, if in the Owner's opinion, the nature or quantity of the Work encountered is such that the Unit Price cost no longer applies to the Work. The Owner also reserves the right to solicit independent proposals as required by the Department of Education guidelines, under a separate contract, to perform the services required. **The responsiveness of the Bid 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 Bid 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.** The Construction Manager 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 deduction.

The contract Unit Price per (UOM) for Unit Price WS-4A as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-4B as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-4C as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-4D as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-4E as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-4F as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-4G as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-4H as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

The contract Unit Price per (UOM) for Unit Price WS-4I as described in Section 01 22 00, Unit Prices and Material Allowances is:

$ _____per (UOM) x Cost extension of quantity indicated in Section 01 22 00:

$_____ (total cost allowance for Unit Price).

(REMAINDER OF PAGE INTENTIONALLY LEFT BLANK)

In witness whereof, the undersigned has caused this Proposal to be executed this _____day of _____ 20_____.

Name of Contractor: _____

State of Incorporation for Contractor: _____

Contractor (Entity) Type: _____

Street Address: _____

City: _____State: _____Zip: _____

Phone Number: _____Fax Number: _____

Name of Representative: _____

Title of Representative: _____

Signature of Representative: _____

Date of Signature: _____

Name of Witness: _____

Signature of Witness: _____

Date of Signature: _____

END OF SECTION 00 41 19

SECTION 00 43 13 - BID SECURITY FORM

The Bid Security Form utilized for this project shall be a “Bid Bond”, included herein in the Project Manual. Reference Section 00 21 13, “Instructions to Bidders” for the execution of the Bid Bond.

END OF SECTION 00 43 13

SECTION 00 43 13 - BID BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____ (hereinafter called the "Principal"), and _____, a corporation authorized to transact business in Pennsylvania, and having its principal office at _____ (hereinafter called the "Surety"), as Surety, are held and firmly bound unto Upper Dublin School District (hereinafter called the "Obligee"), as Obligee, in the sum of _____ _____ Dollars ($_____) lawful money of the United States of America, for payment of which we bind ourselves, and each of our respective heirs, legal representatives, successors and assigns, jointly and severally, by these presents on this _____day of _____, 20____.

WHEREAS, said Principal is herewith submitting to the Obligee a bid to perform work for the Obligee's proposed _____ Project, pursuant to plans, specifications, and other Contract Documents incorporated into said bid by reference; and it is a condition of the Obligee's receipt and consideration of said bid that such shall be accompanied by bid security to be held by the Obligee on terms embodied herein.

THEREFORE, the condition of this obligation is that in the event of acceptance of his bid by Obligee and within the period specified therefore in the bidding requirements, said Principal shall, within the time set forth in the Bidding Documents, provide to the Obligee (i) the required bonds in the required amounts and on the required forms, (ii) certificates of insurance evidencing the coverages and minimum limits required by the Contract documents, (iii) a properly executed Public Works Employment Verification form, and (iv) signed copies of the contract for construction, then this obligation shall be void and of no effect, but otherwise it shall remain in full force. In the event of the failure to enter into such contract, give such bonds, and furnish such certificates within the time specified, the Principal and Surety will pay to the Obligee the amount of this Bid Security together with interest as liquidated damages.

IN WITNESS WHEREOF, the Principal and Surety, intending to be legally bound, have executed this Bond the day and year aforementioned.

(**Individual Principal**) (SEAL)

Signature of Individual

Witness: Trading and doing business as:

_____ _____

(Individual Name)

_____ _____

(Business Name)

****

(Partnership Principal) _____

(Name of Partnership)

Witness:

_____ By: _____

(SEAL) Partner

_____ By: _____

(SEAL) Partner

_____ By: _____

(SEAL) Partner

****

(Corporation Principal) _____

(Name of Corporation)

Attest: _____ By:_____

Secretary/Assistant Secretary President/Vice President

(CORPORATE SEAL)
OR (if applicable)

Attest: _____ *By: _____

Authorized Representative

*Attach appropriate proof, dated as of the same date as the bond, evidencing authority to execute on behalf of the corporation.

****

(CORPORATE SURETY)

_____
Name of Corporation

Witness or Attest:

_____ By: _____
Title

(CORPORATE SEAL)

**Attach an appropriate Power of Attorney, dated as of the same date as the bond, evidencing the authority of the Attorney-in-Fact to act on behalf of the Corporation.

END OF SECTION 00 43 13

SECTION 00 43 15 – 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 agrees intending to be legally bound hereby, to execute and deliver to the Upper Dublin School District, within the time limit specified in the Contract Documents, the Performance Bond and Payment Bond in the forms included in the Contract Documents each in an amount of 100% of the Contract Sum, in favor of the Upper Dublin School District, as required for the faithful performance and proper fulfillment of the Contract for Work Scope No. _____ for the New Jarrettown Elementary School Project, Upper Dublin Township, Montgomery County, Pennsylvania, 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.

Surety further agrees that should the Surety, after notification of intent to make such award, omit or refuse to execute the required bonds and agreement, then the Surety shall pay to the Upper Dublin School District, hereinafter called the Obligee, any difference between the total amount specified in said Bidder's proposal for the required work and the amount of which said Obligee may procure the same work, if the latter amount be in excess of the former, plus any advertising, architectural, legal, and other expenses incurred by Obligee; provided, however, that the obligations of Surety hereunder shall not exceed the amount of bid security provided by the Bidder together with interest.

Dated: _____, 20_____

_____(CORPORATE SURETY)

WITNESS OR ATTEST:

_____ By: _____
Attorney-in-Fact*

NAME: _____
(Please type)

**Attach an appropriate Power of Attorney, dated as of the same date as this Agreement, evidencing the authority of the Attorney-in-Fact to act on behalf of the Corporation.*

END OF SECTION 00 43 15

Upper Dublin School District
New Jarrettown Elementary School
Dresher, PA

Substitution Request

Incomplete forms will not be processed.

SUBSTITUTION REQUEST # _____

Check ONE:

Request during Bidding: ☐

After Bidding/Contract Award: ☐

PROJECT NAME: New Jarrettown Elementary School

TO Ryan Murphy, Phone: 610-368-2373

FROM: _____

DATE: _____

Specification

Section Title: _____

Section Number: _____

Paragraph: _____

Description: _____

Proposed Substitution (*Note: Limit this Request to one substitution)*

Manufacturer: _____ Address: _____

Trade Name: _____ Model Number: _____

Phone Number: _____ Contact Person: _____

Installer: _____ Address: _____

Phone Number: _____ Contact Person: _____

History: ☐ New Product ☐ 1 to 4 years old
☐ 5 to 10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product:

_____

_____

_____

_____

Point by point comparison data attached – REQUIRED

Reason for Not Providing Specified Item:

_____

_____

_____

Similar Installation: Include Date Installed Project: _____

Architect: _____ Address: _____

Owner: _____

_____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; Explain:

_____

_____

_____

Amount of Savings to Owner for this Substitution:$_____

Will Requested Substitution Impact Schedule:☐ No ☐ Yes, Add _____days.

Attached Supporting Data: ☐ Product Data ☐ Drawings ☐ Tests ☐ Reports ☐ Samples

Contractor's Certification
The undersigned party, proposing this Substitution, certifies the following as true and correct and accepts all conditions relating to this request:

- This Substitution has been fully investigated and determined to be equal or superior in all respects.
- The same warranty will be furnished.
- The same maintenance service and source of replacement parts, as applicable, is available.
- The change to the Construction Progress Schedule is as stated above.
- The cost data as stated above is complete. All claims for any additional costs related to this Substitution, if accepted, are explicitly waived by the Contractor.
- The Substitution does not affect dimensions or functional clearances.
- All architectural/engineering design fees associated with the review, evaluation, and or design and detailing changes as a result of this Substitution Request are the responsibility of the Contractor. The amount of these fees will be deducted from the Contract Sum due to the Contractor.
- Coordination, installation, and changes to the Work as necessary for an accepted Substitution will be complete in all respects.

Submitted By: _____

Signature: _____

Firm: _____

Address: _____ Telephone: _____

Consultant's Review and Recommendation

☐ Substitution Recommended: Make submittals in accordance with Specifications.

☐ Substitution Recommended as Noted: Make submittals in accordance with Specifications.

☐ Substitution Rejection Recommended: Use specified products. Architect shall not be held responsible for the performance of any substitution accepted or approved by Owner over the recommendation of the Architect (Release and Indemnification Agreement between Owner and Architect required).

☐ Substitution Request returned: Incomplete submittal, use specified products.

Comments:

_____

_____

_____

Signature: _____ Date: _____

SECTION 00 43 93 - BID SUBMITTAL ATTACHMENTS

1.01 GENERAL

A. The below referenced forms with corresponding Specification Section number shall be submitted in conjunction with Bids. Substitute forms will not be acceptable. All forms shall be fully executed by an authorized person and notary seals applied where indicated.

1. Section 00 11 53, Request for Qualifications, and associated Exhibits A through D:

    a. Exhibit A: General Information
    b. Exhibit B: Financial and Performance Information
    c. Exhibit C: Project-Specific Information
    d. Exhibit D: Past Project Experience

2. Section(s) 00 41 16 through 00 41 19, Bid Form(s) for Work Scope being Bid.
3. Section 00 43 13, Bid Bond Form, if bid security provided is a Bid Bond.
4. Section 00 43 15, Agreement of Surety.
5. Section 00 45 19, Non-Collusion Affidavit.

END OF SECTION 00 43 93

SECTION 00 45 19 – NON-COLLUSION AFFIDAVIT OF CONTRACTOR

STATE OF _____

COUNTY OF _____

_____, being duly sworn, deposes and says that:

(1) He is _____ of _____.
(owner, partner, officer, representative, or agent) (company)

the Bidder who has submitted the attached Bid, and is authorized to make this Affidavit on behalf of the company, and its Owners, Directors, and officers:

(2) He is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not collusive or sham Bid;

(4) Neither the said Bidder nor any if its officers, partners, owners, agents, representatives, employees or parties of interest, including the affiant, has, in any way, colluded, conspired, connived, or agreed to any of the following:

- To work directly or indirectly with any other Bidder, firm or person to submit this Bid.
- To collude in any way to submit or to have submitted a sham Bid for the Contract for which this Bid has been submitted.
- To collude in any way to prevent another Bidder from bidding for this Contract.
- To agree, collude, communicate or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid, or in the Bids of any other Bidder.
- To fix any overhead, profit or cost element of the Bid price or the Bid price of any other Bidder.
- To secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Upper Dublin School District (Owner) or any person(s) in the proposed Contract.

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest including this affiant.

(6) I state that, _____,
(Name of My Firm)

understands and acknowledges that the above representations are material and important and will be relied on by the Upper Dublin 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 the Upper Dublin School District of the true facts relating to the submission of bids for this contract.

_____/S/

_____Title

Subscribed and sworn to before me this

_____day of_____20_____.

Notary Public:_____

My Commission Expires:_____

Note: This document must be completed, signed, notarized and returned with your bid.

END OF SECTION 00 45 19

SECTION 00 50 00 - LIST OF CONTRACT FORMS

1.01 GENERAL

A. The following is a list of forms and standards applicable to this Project.

1.02 FORMS

B. Bid Form: As bound in this Project Manual, Sections 00 41 16 through 00 41 19.
C. Bid Bond Form: As bound in this Project Manual as Section 00 43 13 that complies with all state requirements. Submit with Bid with proper Power of Attorney certificate and acknowledgment.
D. Contract Form: The Contract form will be AIA document A132-2019, as modified. See Agreement included as Section 00 52 13.
E. Performance/Payment Bond: Performance Bond and Payment Bond as provided in the Project Manual as Sections 00 61 14 and 00 61 15 that complies with all state requirements. Submit in two copies, with proper Power of Attorney and acknowledgement within 10 days of the Notice of Intent to Award.
F. Section 00 22 21, Act 141: Public Works Employment Verification Form.

END OF SECTION 00 50 00

SECTION 00 52 13 – STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR - AIA A132

The attached copy of AIA Document A132, Standard Form of Agreement Between Owner and Contractor, as modified, is hereby made a part of the Contract Documents and Specifications. There is no implied permission to reproduce this document. The original document purchased by the user is intended to be consumed in the course of this project.

END OF SECTION 00 52 13

AIA® Document A132® – 2019

Standard Form of Agreement Between Owner and Contractor, *Construction Manager as Adviser Edition*

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)

Upper Dublin School District
1580 Fort Washington Ave.
Maple Glen, PA 19002

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

Work Scope No.1 – General Construction
Work Scope No.2 – Electrical Construction
Work Scope No.3 - Mechanical Construction
Work Scope No.4 – Plumbing/Fire Protection Construction

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

New Jarrettown Elementary School
1520 Limeklin Pike
Dresher, PA 19025

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

ICS Consulting LLC
1400 N. Providence Rd, Building 2, Suite 4045
Media, PA 19063

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

Alloy5, LLC
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. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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 used in conjunction with AIA Documents A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser. AIA Document A232™–2019 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

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

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ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General and other Conditions), Drawings, Specifications and 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 Modifications, appears in Article 9. For purposes of this Agreement, the term "General Conditions" as used herein shall mean the AIA A232-2019, General Conditions of the Contract for Construction, as modified.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents or reasonably inferable by the Contractor as necessary to produce the results intended by the Contract Documents except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND DATES OF 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 fixed date set forth in the Notice to Proceed issued by the Owner or Construction Manager.

[ ] 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 of the Project or Portions Thereof
(Paragraphs deleted)

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§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the date of Substantial Completion of each milestone, each phase, and the entire Work of all of the Contractors for the Project will be:
(Insert the date of Substantial Completion of the Work of all Contractors for the Project.)

Not later than the dates listed in the Contract Documents.

§ 3.3.2 Intentionally deleted.

(Table deleted)

§ 3.4 When the Work of this Contract, or any Portion Thereof, is Substantially Complete

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

[X] Not later than the dates listed in the Contract Documents

[ ] By the following date:

§ 3.4.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work of this Contract are to be substantially complete prior to when the entire Work of this Contract shall be substantially complete, the Contractor shall substantially complete such portions by the following dates:

Portion of Work	Date to be substantially complete
Phase 1	June 20, 2029
Phase 2	February 27, 2030

§ 3.4.3 If the Contractor fails to substantially complete the Work of this Contract, or portions thereof, as provided in this Section 3.4, liquidated damages, shall be assessed as set forth in General Conditions.

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 one of the following:
(Check the appropriate box.)

[X] Stipulated Sum, in accordance with Section 4.2
(Paragraphs deleted)
below.

§ 4.2 Stipulated Sum

§ 4.2.1 The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2.2 Alternates

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

Item	Price

§ 4.2.2.2 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

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§ 4.2.3 Allowances, if any, included in the Contract Sum: Project Material Allowances included in the Stipulated Sum are listed on Contractor's Bid Form, attached hereto as Exhibit D, and made a part hereof. No quantity limitations shall apply to the Project. The allowances shall be solely owned by the Owner and, as such, the Owner shall have the sole discretion relating to the use of these allowances. Furthermore, any unused portion of the allowances shall be deducted from the Contractor's Contract Sum. The Contractor shall receive no compensation on the unused portion of the allowances. The Contractor will be required to furnish documentation to the Owner evidencing the expenditures to be charged to the allowance and the reasons therefor prior to the Owner's approval of expenditures from the allowances.

(Table deleted)
§ 4.2.4 Unit prices, if
(Paragraphs deleted)
any, are as listed on Contractor's Bid Form, attached here to as Exhibit D, and made a part hereof.
(Table deleted)
§ 4.3 Cost of the Work Plus Contractor's Fee without a Guaranteed Maximum Price

§ 4.3.1 Intentionally deleted.
(Paragraph deleted)
(Table deleted)
(Paragraphs deleted)

§ 4.4 Cost of the Work Plus Contractor's Fee with a Guaranteed Maximum Price

§ 4.4.1 Intentionally deleted.

(Paragraphs deleted)
(Table deleted)
(Paragraphs deleted)
(Table deleted)
(Paragraphs deleted)
(Table deleted)
(Paragraphs deleted)
(Table deleted)
(Paragraphs deleted)
§ 4.5 Liquidated damages, if any, in accordance with the General Conditions.

(Paragraphs deleted)
ARTICLE 5 PAYMENTS
§ 5.1 Progress Payments
§ 5.1.1 In accordance with the provisions of AIA A232-2019 General Conditions of the Contract, based upon Applications for Payment submitted to the Construction Manager by the Contractor, and Certificates for Payment issued by the Construction Manager and Architect, the Owner or their designated representative 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 In accordance with the provisions of AIA A232-2019 General Conditions of the Contract. The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows.

Except as set forth elsewhere in the Contract Documents, payments to the Contractor will be made monthly for work completed as of the last calendar day of the month or during a period of one calendar month ending on a day mutually agreed to by the Owner and the Contractor provided that all requirements of the Contract Documents have been and are complied with by the Contractor.

§ 5.1.3 Provided that an Application for Payment is received by the Construction Manager not later than the 25th 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 Construction Manager 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 Construction Manager

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receives the Application for Payment. The Contractor hereby expressly waives any rights to penalties, interest, and attorney's fees that the Contractor has or may have under the Pennsylvania Prompt Pay Act, 62 Pa.C.S.A. § 3931, et seq. as amended from time to time.

§ 5.1.4 Progress Payments Where the Contract Sum is Based on a Stipulated Sum

§ 5.1.4.1 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 Construction Manager and Architect may require. This schedule of values, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.4.2 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.

§ 5.1.4.3 In accordance with AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

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

.1 That portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Sum allocated to that portion of the Work in the schedule of values, less the retainage; and;

.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

§ 5.1.4.3.2 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 Construction Manager or the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A232–2019;

.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 Construction Manager or the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A232–2019; and

.5 Retainage withheld pursuant to Section 5.1.7.

(Paragraphs deleted)

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to when the Work of this Contract is substantially complete, the Owner may withhold

(Paragraphs deleted)

retainage as set forth in Section 9.3.4 of the AIA A232 - 2019.

(Paragraphs deleted)

§ 5.2 Final Payment

§ 5.2.1 Final Payment Where the Contract Sum is Based on a Stipulated Sum

§ 5.2.1.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor as set forth in the General Conditions and 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 A232–2019, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect or Construction Manager; and

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.3 the Contractor has completed all Work in compliance with all applicable codes, law, ordinances, and regulations which affect the Project and the Work has passed all inspections.

§ 5.2.1.2 Intentionally deleted.

(Paragraphs deleted)
§ 5.3 Except as otherwise set for in the Contract Documents, payments due and unpaid under the Contract shall bear interest
(Paragraphs deleted)
at a rate of three percent (3%) simple interest per annum from the date the payment is due.

ARTICLE 6 DISPUTE RESOLUTION
§ 6.1 Initial Decision Maker
The Architect will serve as Initial Decision Maker pursuant to Article 15.2 of AIA Document A232–2019, unless the parties appoint below another individual, not a party to this Agreement, to serve as 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.)

§ 6.2 Binding Dispute Resolution
For any Claim involving the Contractor and Owner, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Litigation in a court of competent jurisdiction.

[X] Other: *(Specify)*

Per Article 15.4 of the General Conditions

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 Where the Contract Sum is a Stipulated Sum
§ 7.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2019.

§ 7.1.1.1
(Paragraphs deleted)
Intentionally deleted.

§ 7.1.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019.

(Paragraphs deleted)
ARTICLE 8 MISCELLANEOUS PROVISIONS
§ 8.1 Terms in this Agreement shall have the same meaning as those in AIA Document A232 - 2019 as amended for the Project. Where reference is made in this Agreement to a provision of AIA Document A232–2019, General Conditions, or another Contract Document, the reference refers to that provision as amended, modified, deleted or supplemented by other provisions of the Contract Documents.

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

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Robert Lester, Director of Facilities
Upper Dublin School District
1580 Fort Washington Ave.
Maple Glen, PA 19002

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

§ 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 Article 11 of the AIA Document A232™–2019, Standard Form of Agreement Between Owner and Contractor, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as amended for the Project, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in Article 11.1.2 AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as amended for the Project, and elsewhere in the Contract Documents.

§ 8.6
(Paragraphs deleted)
Intentionally deleted.

§ 8.7 Relationship of the Parties

The Contractor accepts the relationship of trust and confidence established by this Agreement and covenants with the Owner to cooperate with the Architect and Construction Manager and exercise the Contractor's skill and judgment in furthering the interests of the Owner; to furnish efficient business administration and supervision; to furnish at all times an adequate supply of workers and materials; and to perform the Work in an expeditious and economical manner consistent with the Owner's interests. The Owner agrees to furnish and approve, in a timely manner, information required by the Contractor and to make payments to the Contractor in accordance with the requirements of the Contract Documents.

§ 8.8 Other provisions:

§ 8.8.1 The Owner and Contractor acknowledge that no representations, inducements, promises, or agreements, orally or otherwise, have been made by any party or by anyone acting on behalf of any party which are not embodied in this Agreement, and that any agreement, statement or promise that is not contained in this Agreement shall not be valid or binding on any party and shall not have any force or effect.

§ 8.8.2 As between Architect, Construction Manager and Contractor, it is understood that the Architect and Construction Manager shall not be held responsible to Contractor for any errors or omissions on the part of Contractor, including, but not limited to, the Contractor's failure to adhere to the plans and specifications, regardless of whether or not the Architect or Construction Manager is performing observation services.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- **.1** AIA Document A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition, as amended for the Project
- **.2** AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as amended for the Project

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(Paragraphs deleted)

.3 Drawings – Exhibit A.

(Table deleted)

.4 Specifications – Exhibit B.

(Table deleted)

.5 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.

.6 Other Exhibits:
Exhibit C – Contractor's completed Bid Form
Exhibit D – Contractor's executed Non-Collusion Affidavit
Exhibit E – Contractor's executed Public Work Employment Verification Form

(Paragraphs deleted)

Exhibit F – Contractor's executed Performance and Payment Bonds

(Table deleted)

*(Paragraphs deleted)*Exhibit G - Contractor's Certificate of Insurance

This Agreement is 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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SECTION 00 61 13 – PERFORMANCE AND PAYMENT BOND FORMS

A. Within ten (10) days of receipt of the Notice of Intent to Award , the successful Bidder shall furnish a Performance Bond (00 61 14) and a Payment Bond (00 61 15) in the forms provided in these Bid Documents, each in the amount of one hundred percent (100%) of the Contract Sum. No other forms will be accepted. There is no implied permission to reproduce this document. The original document purchased by the user is intended to be consumed in the course of this project.

B. The Attorney-in-Fact who executes the Performance and Payment Bonds on behalf of the surety shall affix to the bonds a certified and current copy of its Power of Attorney, authorizing said Attorney-in-Fact to act on behalf of the surety, and a valid Certificate of Authority from the Pennsylvania Department of Insurance. The Power of Attorney must be dated the same day as the bonds and both the bonds and Power of Attorney shall have affixed the raised corporate seal of the surety.

C. The Performance and Payment Bonds must be executed by a surety licensed and authorized to conduct business within the Commonwealth of Pennsylvania and named in the current list of companies holding Certificates of Authority as accepted sureties on Federal Bonds and 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 or revision thereof.

END OF SECTION 00 61 13

SECTION 00 61 14 - PERFORMANCE BOND

And Now, we _____ as Principal (the “Principal”), and _____, a Corporation organized and existing under the laws of the _____ of _____ as Surety (the “Surety”), are jointly and severally held and firmly bound to the Upper Dublin School District, its successors and assigns (the “Obligee”), for the performance of the Contract hereinafter identified and incorporated herein by this reference in the sum of _____, lawful money of the United States of America to be paid to the Obligee; to which performance or payment, well and truly to be made, we bind ourselves and each of our successors and assigns, jointly and severally.

I. RECITALS

WHEREAS, the Principal has submitted to the Obligee a certain proposal, dated _____ (the "Proposal"), to perform certain _____(Name of Contract) for the _____(Name of Project) for the Obligee, in connection with plans, specifications and other related documents, which are incorporated into the Proposal by reference (the "Contract Documents"); and

WHEREAS, the Obligee, is a "contracting body" under provisions of Act No. 385 of the General Assembly of the Commonwealth of Pennsylvania, approved by the Governor on December 20, 1967, known as and cited as the "Public Works Contractors' Bond Law of 1967" (the "Act");

WHEREAS, the Act, in Section 3 (a), requires that, before an award shall be made to the Principal by the Obligee in accordance with the Proposal, the Principal shall furnish this Bond to the Obligee, with this Bond to become binding upon the award of a contract to the Principal by the Obligee in accordance with the Proposal; and

WHEREAS, it also is a condition of the Contract Documents that this Bond shall be furnished by the Principal to the Obligee and

WHEREAS, under the Contract Documents, it is provided, inter alia, that if the Principal shall furnish this Bond to the Obligee, and if the Obligee shall make an award to the Principal in accordance with the Proposal, then the Principal and the Obligee shall enter into an agreement with respect to performance of such work (the "Agreement"), the form of which Agreement is set forth in the Contract Documents.

II. CONDITIONS OF BOND

NOW, THEREFORE, the terms and conditions of this Bond are and shall be that if:

(a) the Principal well, truly, and faithfully shall comply with and shall perform the Agreement in accordance with the Contract Documents, at the time and in the manner provided in the Agreement and in the Contract Documents, and if the Principal shall satisfy all claims and demands incurred in or related to the performance of the Agreement by the Principal or growing out of the performance of the Agreement by the Principal, and if the Principal shall indemnify completely and shall hold harmless the Obligee and all of its officers, directors, agents or employees from any and all costs and damages which the Obligee and any or all of its officers, directors, agents and employees may sustain or suffer including, but not limited to, attorney’s fees, costs, expenses and interest by reason of the failure of the Principal to do so, and if the Principal shall reimburse completely and pay to the Obligee any and all costs, damages and

expenses, including interest and attorney's fees) which the Obligee and any or all of its officers, directors, agents and employees may incur by reason of any such default or failure by the principal and

(b) the Principal shall remedy, without cost to the Obligee, all defects, deficiencies or failures in any labor, materials or equipment performed or provided by the Principal in its performance of the Agreement which may develop during the period of one (1) year from the date of final completion by the Principal and final acceptance of the Obligee of the work to be performed under the Agreement in accordance with the Contract Documents, which defects, in the sole judgment of the Obligee or its legal successors in interests, shall be caused by or shall result from defective or inferior materials or workmanship, then this Bond shall be void; otherwise, this Bond shall be and shall remain in force and effect.

We further agree to indemnify and hold harmless the Obligee against any and all costs, liabilities, expenses, attorney's fees and obligations which the Obligee sustains by reason of the failure of the Principal or the Surety to comply with the terms of the Contract Documents or this Obligation. This Bond is executed and delivered under and subject to the Act, to which reference hereby is made.

The Principal and the Surety agree that any alterations, changes or additions to the Contract Documents, or any alterations, changes or additions to the work to be performed under the Agreement in accordance with the Contract Documents, or any alterations, changes or additions to the Agreement, or any act of forbearance of either the Principal or the Obligee toward the other with respect to the Contract Documents and the Agreement, or the reduction of any percentage to be retained by Obligee as permitted by the Contract Documents and by the Agreement, shall not release in any manner whatsoever, the Principal and the Surety or either of them, their heirs, executors, administrators, successors and assigns, from liability and obligations under this Bond; and the Surety, for value received, waives notice of any such alterations, changes, additions, extensions of time, acts of forbearance or reduction of retained percentage.

It is further agreed that, in the sole discretion of the Obligee and upon notice therefrom, the Surety may be required to perform and carry out the provisions of the Contract in the event of a breach thereof by the Principal, whereupon the rights and responsibilities of the Surety and the Obligee to each other shall be the same as those of the Principal and the Obligee immediately prior to the breach giving rise to the Surety's obligation hereunder. If the Surety does not proceed promptly to render such performance or cause such performance to be rendered by a third party satisfactory to the Obligee, then, the Surety shall be deemed to be in default on this obligation fifteen (15) days after the receipt of notice from Obligee that the Surety shall so proceed, and the Obligee shall be entitled to enforce against Surety any remedy it may then or thereafter have against the Principal. If the Principal is a foreign corporation (incorporated under any laws other than those of the Commonwealth of Pennsylvania) then further terms and conditions of this Bond are and shall be that the Principal or the Surety shall not be discharged from liability on this, nor this Bond surrendered until such Principal files with the Obligee a certificate from the Pennsylvania of Revenue evidencing the payment in full of all bonus taxes, penalties and interest, and a certificate from the Bureau of Employment and Unemployment Compensation of the Pennsylvania Department of Labor and industry, evidencing the payment of all unemployment compensation, contributions, penalties and corporations, subcontractors thereunder or for such liability has accrued but the time for payment has not arrived, all in accordance with provisions of the Act of June 10,1947, P.L. 493, of the Commonwealth of Pennsylvania.

This obligation incorporates by reference the Public Works Contractors' Bond Law of 1967, provided, however, that in the event of any inconsistencies or ambiguity in the meaning of this obligation and the said Public Works Contractors' Bond Law of 1967 the express terms of this obligation shall govern and control.

IN WITNESS WHEREOF, the Principal and Surety cause this Bond to be signed, sealed and delivered this _____ day of _____, 20__.

ATTEST:

_____

(CORPORATE SEAL)

[NAME OF CORPORATION]

By: _____
President

or, if appropriate

WITNESS

_____

(CORPORATE SEAL)

[NAME OF CORPORATION]

By: _____
Authorized Representative

*Attach appropriate proof, bearing date of Bond, evidencing authority to act for Corporation

WITNESS

_____

(CORPORATE SEAL)

_____
Corporate Surety

By: _____
Attorney-in-Fact

Issuing Office:

_____
Address

_____
City, State, Zip

IMPORTANT:

Surety companies executing Bonds must appear on the Commonwealth of Pennsylvania Insurance Department's most current licensed company list and be authorized to transact business as a surety in the Commonwealth of Pennsylvania and have an AM Best rating of "A-" or higher.

END OF SECTION 00 61 14

SECTION 00 61 15 - PAYMENT BOND

KNOW THESE MEN BY THESE PRESENTS that we, _____ _____, as Principal (the "Principal"), and _____, a corporation organized and existing under laws of _____ _____ of _____, Surety (the "Surety", are held and firmly bound unto Upper Dublin School District as Obligee (the "Obligee"), as hereinafter set forth, in the full and just sum of _____ _____ Dollars ($_____) lawful money of the United States of America, for the payment of which we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WITNESSETH THAT:

WHEREAS, the Principal heretofore has submitted to the Obligee a certain proposal, dated ,20____ (the "Proposal"), to perform certain _____Work for the Obligee, in connection with _____pursuant to plans, specifications and other related documents, which are incorporated into the Proposal by reference

(the "Contract Document"), as prepared by the Obligee.

WHEREAS, the Obligee, is a "contracting body" under the provisions of Act No. 385 of the General Assembly of the Commonwealth of Pennsylvania, approved by the Governor on December 20, 1967, known as and cited as the "Public Works Contractors' Bond Law of 1967" the "Act");

WHEREAS, the Act, in Section 3 (a), requires that, before an award shall be made to the Principal by the Obligee in accordance with the Proposal, the Principal shall furnish this Bond to the Obligee, with this Bond to become binding upon the award of a contract to the Principal by the Obligee in accordance with the Proposal; and

WHEREAS, it also is a condition of the Contract Documents that this Bond shall be furnished by the Principal to the Obligee and

WHEREAS, under the Contract, it is provided, inter alia, that if the Principal shall furnish this Bond the Obligee, and if the Obligee shall make an award to the Principal in accordance with the Proposal, then the Principal and the Obligee shall enter into an agreement with respect to performance of such work (the "Agreement"), the form of which Agreement is set forth in the Contract Documents.

NOW, THEREFORE, the terms and conditions of the bond are and shall be that if the Principal and any subcontractor of the Principal to whom any portion of the work under the Agreement shall be subcontracted, and if all assignees of the Principal and of any such subcontractor, promptly pay or shall cause to be paid, in full, all money which may be due any claimant supplying labor or materials in the prosecution and performance of the work in accordance with the Agreement and in accordance with the Contract Documents, including any amendment, extension or addition to the Agreement and/or to the Contract Documents, for material furnished or labor supplied or labor performed, then this Bond shall be void, otherwise, the Bond shall be and shall remain in force and effect.

This Bond, as provided by the Act, shall be solely for the protection of claimants supplying labor or materials to the Principal or to any subcontractor of the Principal in the prosecution of the work covered

by the Agreement, including any amendment, extension or addition to the Agreement. The term "Claimant", when used herein and as required by the Act, shall mean any individual, firm, partnership, association or corporation. The phase "Labor or Materials" when used herein and as required by the Act, shall include public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the site of the work covered by the Agreement. As required by the Act, the provisions of this Bond shall be applicable whether or not the material furnished or labor performed enters into and becomes a component part of the public building, public work or public improvement contemplated by the Contract Documents and the Agreement.

As provided and required by the Act, the Principal and the Surety agree that any claimant, who has performed labor or furnished material in the prosecution of the work in accordance with the Agreement and in accordance with the Contract Documents, including any amendment, extension or addition to the Agreement, and/or to the Contract Documents, and who has not been paid therefore, in full, before the expiration of ninety (90) days after the day on which such claimant performed the last of such labor or furnished the last of such materials for which payment is claimed, may institute an action upon this Bond, in the name of the claimant in assumpsit, to recover any amount due the claimant for such labor or material; and may prosecute such action to final judgment and may have execution upon the judgment provided however, that: (a) any claimant who has a direct contractual relationship with any subcontractor of the Principal but has contractual relationship, express or implied, with the Principal, may institute an action upon this Bond only if such claimant first shall have given written notice, served in the manner provided in the Act, to the Principal, within ninety (90) days from the date upon which such claimant performed the last of the labor or furnished the last of the materials for which payment is claimed, stating, with substantial accuracy, the amount claimed and the name of the person for whom the work was performed or to whom the material was furnished; and (b) no action upon this bond shall be commenced after the expiration of one (1) year from the day upon which the last of the labor was performed or material supplied, for the payment of which such action is instituted by the claimant; and (c) every action upon this Bond shall be instituted either in the appropriate court of the County where the Agreement is to be performed or of such other County as Pennsylvania statutes shall provide, or in the United States District Court for the district in which the project, to this Agreement relates, is situated, and not elsewhere.

This Bond is executed and delivered under and subject to the Act, to which reference hereby is made.

The Principal and the Surety agree that any alterations, changes and/or additions to the Contract Document, and/or any alterations, changes and/or additions to the work to be performed under the Agreement in accordance with the Contract Documents, and/or any alterations, changes and/or additions to the Agreement, and/or any giving by the Obligee of any extensions of time for the performance of the Agreement in accordance with the Contract Documents, and/or any act of forbearance of either the Principal or the Obligee toward the other with respect to the Contract Documents and the Agreement, and/or the reduction of any percentage to be retained by the Obligee as permitted by the Contract Documents and by the Agreement, shall not release in any manner whatsoever, the Principal and the Surety, or either of them, their heirs, executors, administrators, successors and assigns, from liability and obligations under this Bond; and the Surety, for value received, does waive notice of any such alterations, changes, additions, extensions of time acts of forbearance and/or reduction of retained percentage.

Provided, that it is expressly agreed that this Bond shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract Documents not increasing the contract price more than twenty percent (20%), so as to bind the Principal and the Surety to the full and faithful performance of the Contract Documents as so amended. The term "Amendment", wherever used in this Bond and whether referring to this Bond, the Contract Documents,

or the Agreement, shall include any alteration, addition, extension or modification of any character whatsoever.

Provided, further, that no final settlement between the Obligee and the Principal shall abridge the right of any beneficiary, whose claim may be unsatisfied.

If the Principal is a foreign corporation (incorporated under any laws other than those of the Commonwealth of Pennsylvania) then further terms and conditions of this Bond are and shall be that the Principal or the Surety shall not be discharged from liability on this Bond, nor this Bond surrendered until such Principal files with the Obligee a certificate from the Pennsylvania Department of Revenue evidencing the payment in full of all bonus taxes, penalties and interest, and a certificate from the Bureau of Employment and Unemployment Compensation of the Pennsylvania Department of Labor and Industry, evidence the payment of all unemployment compensation, contributions, penalties and interest due the Commonwealth from said Principal or any foreign corporations, subcontractors thereunder or for which liability has accrued but the time for payment has not arrived, all in accordance with provisions of the Act of June 10, 1947, P.L. 493, of the Commonwealth of Pennsylvania.

IN WITNESS WHEREOF, the Principal and the Surety cause this Bond to be signed, sealed and delivered this _____ day of _____, 20_____.

(Individual Principal)

WITNESS: _____ (SEAL)
(Signature of Individual)
trading and doing business as

_____ _____

* * * * * * * * *

(Partnership Principal)

WITNESS: _____
(Name of Partnership)

_____ BY: _____(SEAL)
Partner

_____ BY: _____(SEAL)
Partner

_____ BY: _____(SEAL)
Partner

****

(Corporation Principal)

ATTEST: _____
(Name of Corporation)

_____ BY: _____
(Secretary) (President)

(CORPORATE SEAL)

or (if appropriate)

WITNESS: _____ (Name of Corporation)

_____ *BY: _____ (Authorized Representative)

*Attach appropriate proof, dated as of the same date as the Bond, evidencing authority to execute in behalf of the corporation.

_____ **BY: _____ (Attorney-in-fact)

**Attach an appropriate power of attorney, dated as of the same date as the Bond, evidencing the authority of the Attorney-in-fact to act in behalf of the corporation.

END OF SECTION 00 61 15

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 01/01/20xx

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:
BEST INSURANCE AGENCY 123 MAIN ST ANYTOWN PA #####	PHONE (A/C, No, Ext): 610.868.8507 FAX (A/C, No): 610.868.7604 E-MAIL ADDRESS: PRODUCER CUSTOMER ID #:

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
BEST CONTRACTING INC 123 MAIN ST ANYTOWN, PA #####	INSURER A : INSURANCE COMPANY	
	INSURER B :	
	INSURER C :	
	INSURER D :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER: SAMPLE COI** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY PRO-JECT LOC			123456789	DATE	DATE	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 1,000,000 $ 1,000,000 $ CONTRACT $ 1,000,000 $ 2,000,000 $ 1,000,000
A	AUTOMOBILE LIABILITY X ANY AUTO ALL OWNED AUTOS SCHEDULED AUTOS HIRED AUTOS NON-OWNED AUTOS			123456789	DATE	DATE	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 1,000,000 $ $ $
B	X UMBRELLA LIAB X OCCUR EXCESS LIAB CLAIMS-MADE DEDUCTIBLE RETENTION $			123456789	DATE	DATE	EACH OCCURRENCE AGGREGATE	$ 11,000,000 $ 11,000,000
C	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N N / A (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below			123456789	DATE	DATE	X WC STATU-TORY LIMITS OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 500,000 $ 500,000 $ 500,000
	POLLUTION LIABILITY			123456789	DATE	DATE	EACH OCCURRENCE AGGREGATE	$ $1,000,000 $ $1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

UMBRELLA# (INSERT POLICY NUMBER) PROVIDES EXCESS COVERAGE OVER GENERAL LIABILITY, AUTO, AND WORKERS COMPENSATION. UPPER DUBLIN SCHOOL DISTRICT, ALLOY5, ICS AND ALL CONSULTANTS; AND EACH OF THE OFFICERS, AGENTS, AND EMPLOYEES, UPPER DUBLIN TOWNSHIP AND ITS EMPLOYEES AND MONTGOMERY COUNTY CONSERVATION DISTRICT ARE NAMED AS ADDITIONAL INSURED ON ALL POLICIES PERTAINING TO THIS PROJECT.

CERTIFICATE HOLDER	CANCELLATION
UPPER DUBLIN SCHOOL DISTRICT 1580 FORT WASHINGTON AVENUE MAPLE GLEN, PA 19002	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED TO THE CERTIFICATE HOLDER THIRTY (30) DAYS BEFORE THE EFFECTIVE DATE OF ANY SUCH CANCELLATION IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE

ACORD 25 (2009/09)
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SECTION 00 72 00 - GENERAL CONDITIONS

1.01 GENERAL

A. The attached copy of AIA Document A232, General Conditions of the Contract for Construction, 2019 Edition, Articles 1 through 15, is hereby made a part of the Contract Documents and Specifications. There is no implied permission to reproduce this document. The original document purchased by the used is intended to be used during the course of this Project. This document shall always be the most recent form unless otherwise noted by ICS to be a certain year or edition posted by the AIA.

END OF SECTION 00 72 00

AIA® Document A232® – 2019

General Conditions of the Contract for Construction, *Construction Manager as Adviser Edition*

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

New Jarrettown Elementary School
1520 Limeklin Pike
Dresher, PA 19025

THE CONSTRUCTION MANAGER:
(Name, legal status, and address)

ICS Consulting LLC
1400 N. Providence Rd, Building 2, Suite 4045
Media, PA 19063

THE OWNER:
(Name, legal status, and address)

Upper Dublin School District
1580 Fort Washington Ave.
Maple Glen, PA 19002

THE ARCHITECT:
(Name, legal status, and address)

Alloy5, LLC
530 West Broad Street
Bethlehem, PA 18018

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. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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 used in conjunction with AIA Documents A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

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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 and other Conditions), Instructions to Bidders, 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.

§ 1.1.1.1 The Contractor is responsible to read the entire AIA A232-2019 General Conditions of the Contract for Construction as it has been modified from the original AIA Document A232-2019.

§ 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 the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager or the Construction Manager's consultants, (5) between the Owner and a Subcontractor or Sub-subcontractor (6) between the Construction Manager and the Architect, or (7) except as provided in Article 6 of these General Conditions, between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties. Each Subcontractor, having received and reviewed the Contract Documents, as evidenced by its execution of a subcontract with the Contractor, agrees that these General Conditions have been incorporated in the Subcontractor's subcontract by reference and, to the extent such General Conditions conflict with the express provisions of the subcontract with respect to obligations Subcontractor may have to Owner, these General Conditions shall take precedence.

§ 1.1.2.1 Contractor acknowledges and warrants that it has closely examined all of the Contract Documents, that they are suitable and sufficient to enable the Contractor to complete the Work in a timely manner for the Contract Sum, and that they include all Work, whether or not shown or described, which reasonably may be inferred to be required or useful for the completion of the Work in full compliance with all applicable codes, laws, ordinances, regulations and/or requirements of any local, state, federal or other governmental agency.

§ 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, and further including any Subcontractor and Sub-subcontractor Work, material suppliers, and/or any other entity from whom the Contractor is responsible whether on or off the site of the Project. The Work may constitute the whole or a part of the Project.

§ 1.1.3.1 The Work shall include, without limitation, the obligation of the Contractor to visit the Project site before submitting a Bid. Such site visit shall be for the purpose of familiarizing the Contractor with the conditions as they exist and the character of the operations to be carried on under the Contract Documents, including, without limitation, all existing site conditions, access to the site, and the physical characteristics of the site and surrounding areas.

§ 1.1.3.2 Nothing in these General Conditions shall be interpreted as imposing on either the Owner, Construction Manager or Architect, or their respective 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, since these are the sole responsibility of the Contractor.

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§ 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 other Contractors, and by the Owner's own forces and Separate Contractors.

§ 1.1.5 Contractors. Contractors are persons or entities, other than the Contractor or Separate Contractors, who perform Work under contracts with the Owner that are administered by the Architect and Construction Manager. This includes all Prime Contractors who have mutual responsibility to each other.

§ 1.1.6 Separate Contractors. Separate Contractors are persons or entities who perform construction under separate contracts with the Owner not administered by the Architect and Construction Manager.

§ 1.1.7 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.

§ 1.1.7.1 The Drawings are diagrammatical and show the general arrangement and extent of the Work; exact locations and arrangements of parts shall be determined as the Work progresses and shall be subject to the Architect's approval. No extra compensation will be allowed due to conflicts, inconsistencies, or discrepancies between actual dimensions and those indicated. The right is reserved by the Architect to make any reasonable change in location of equipment, ductwork and piping prior to roughing in without involving additional compensation to the Prime Contractors. Each Prime Contractor shall coordinate its Work with the Work of others, so that interference between trades does not occur. Each Prime Contractor shall furnish and install offsets, bends, turns, and the like in connection with its Work to avoid interference with Work of other Contractors, to conceal Work where required, and to secure necessary clearance and access for operation and maintenance.

§ 1.1.7.2 Contractor shall carefully examine the Architectural, Mechanical, Plumbing, Electrical, and other 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 and Construction Manager 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 and Construction Manager.

§ 1.1.8 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.

§ 1.1.9 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.

§ 1.1.10 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 and in accordance with the applicable standard of care.

§1.1.11 Construction Manager: The terms Program Manager (PM) and Owner's Representative shall be interchangeable with Construction Manager (CM) for this Project and shall mean ICS Consulting, Inc.

§ 1.1.12 Owner: The term Owner shall refer to the Upper Dublin School District.

§ 1.1.13 All references to "Architect" shall mean "Architect/Engineer."

§ 1.1.14 Completion Date: The term Completion Date means any substantial completion, final completion, milestone, phase, or other time sensitive date identified in the Contract Documents.

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§ 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 unless it is specified that the Contract includes specific phases or elements to complete a certain part of the Work for reason of coordination or responsibility. Where the Specification has been divided into sections, it is for convenience in use. Unless otherwise specified, the scope of Work of each section shall be to furnish labor, materials, equipment, skill, erection, installation, services and related items for the phase of Work of that section, as required by the Drawings, as specified or as otherwise required to provide and complete the entire Work of the section.

§ 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.

§ 1.2.1.2 Notwithstanding anything else to the contrary in the Contract Documents, in the event of conflicts, inconsistencies or discrepancies between and/or within the Contract Documents and/or applicable codes, laws, ordinances, regulations and/or requirements of any state, federal or any other governmental agency, the Contractor shall (1) provide the better quality or greater quantity of Work or (2) comply with the more stringent requirement, or both, in accordance with the Architect's interpretation. The terms and conditions of this Section 1.2.1.2, however, shall not relieve the Contractor of any of the obligations set forth in Sections 3.2 and 3.7.

§ 1.2.1.3 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

1. Change Orders
2. Construction Change Directives
3. Architect's Supplemental Instructions / Minor Change Orders
4. Agreement
5. Addenda
6. Supplementary Conditions
7. General Conditions
8. Specifications
9. Drawings
10. Large-scale Drawings shall supersede smaller-scale Drawings
11. Dimensions shall govern over scaling of the Drawings
12. In the case of conflicts, inconsistencies or discrepancies in the Drawings or in the Specifications or within Documents not clarified by Addendum, the latter shall be submitted to the Construction Manager and Architect, who will promptly provide a determination in writing. In the case of a conflict, inconsistency, or discrepancy between and/or within the Drawings and Specifications not clarified by Addendum, the better quality or greater quantity of Work shall be provided in accordance with the Initial Decision Maker's or Architect's interpretation, and no additional compensation or extension of time will be allowed.

§ 1.2.1.4 If a minor change in the Work is found necessary due to actual field conditions, each Contractor shall submit detailed drawings of such departure for the approval by the Architect before making the change.

§ 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. The Contractor represents that the Subcontractors, manufacturers, and suppliers engaged or to be engaged by it are and will be familiar with the requirements for performance by them.

§ 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,**§ 1.2.4** Where the Work is shown in complete detail on only a portion of the Drawings or

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there is an indication of continuation, the remainder being shown in outline, the Work drawn out in detail shall be understood to apply to the other portions of the structure. The Drawings and Specifications are intended to be a common and complimentary set of documents. Anything shown on the Drawings but not in Specifications shall be equally binding as if both noted on the Drawings and called for in the Specifications.

§ 1.2.5 No measurement of a drawing by scale shall be used as working dimension. Working measurements shall be taken from figure dimensions. Work shown diagrammatically on Drawings shall be agreed upon for exact location before being installed. Where the activities of two or more trades are in close proximity, the Contractor shall confer with the other Prime Contractor(s) concerned before making its installation. Work installed by the Contractor in an arbitrary manner without regard for the work of other Separate Contractors or Prime Contractors shall be promptly repaired and/or replaced by the Contractor to the satisfaction of the Architect at no additional cost to the Owner.

§ 1.2.6 The Contractor shall carefully examine the civil, architectural, plumbing, electrical, fire protection and other Drawings and Specifications. If any conflicts, inconsistencies, or discrepancies occur between and/or within the Drawings and Specifications and is discovered after the submission of bids, the Contractor shall promptly report such a conflict, inconsistency, or discrepancy 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 the prior written approval of the Architect and written notice to the Owner.

§ 1.2.7 The Drawings and Specifications, as a part of the Contract Documents, are for the purpose of illustrating and describing the general character and extent of the Work; and they are intended to agree and be mutually explanatory. Further, it is the intention that these instruments of service shall be complete in their meaning and shall represent completeness in design as well as any fragments thereof. It is the intent and purpose of the Specifications and Drawings to cover and include each item of material, machinery, apparatus, equipment, labor, and services necessary to properly install, equip, adjust, and put into perfect operation the respective portions of the installations specified, and to so interconnect the various items or sections of the Work as to form a complete and operating whole, and deliver the Work in the specified time. Any apparatus, machinery, material, equipment, labor, and services not specifically mentioned which may be found necessary to complete or perfect any portion of the Work in a substantial manner, and in compliance with the requirements stated, implied, or intended in the Contract Documents, shall be furnished without extra cost to the Owner. This shall include all material, devices, or methods peculiar to the type of construction furnished and installed by the Contractor.

§ 1.2.8 If the Contractor, in the course of the Work, finds any discrepancy between the Drawings and the physical conditions of the locality, or any errors in Drawings or in the layout as given by the points and instruction, the Contractor shall immediately inform the Construction Manager and Architect in writing and the Construction Manager and Architect, with reasonable promptness, shall verify the same. Any work done after such discovery, until authorized, shall be done at the Contractor's risk.

§ 1.2.9 In Multiple Prime Contract construction where the Contract Documents duplicate the same work or materials under more than one Prime Contract or subcontract, such duplication shall be settled by the Construction Manager and Architect in writing upon request of a Prime Contractor concerned prior to submission of Bid. Any such duplication which may exist in the Contract Documents after Bids are received will be interpreted by the Construction Manager and Architect as having duplicate values in the multiple contracts or subcontracts and proper credit to the Owner, therefore shall be made by the Contractors as the Architect shall designate.

§ 1.2.10 Division 01 shall govern the execution of all Specification Sections.

§ 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. Unless otherwise indicated, any reference to a Section means the Section of these General Conditions, including any subsections thereof.

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

§ 1.5.1 Except as otherwise agreed to between Owner and Architect, 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 any reserved rights thereto.

§ 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, or the Agreement, 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, as applicable.

§ 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.

§ 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.

§ 1.6.3 Written Notice

Written notice shall be deemed to have been duly served if delivered by registered or certified mail or by courier service providing proof of delivery to party's respective address identified in the Agreement, or by electronic transmission provided that the party providing notice receives a delivery notification confirming receipt of its sent communication.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon 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 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.

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 Construction Manager and the Architect do not have such authority. The term "Owner" means the Owner or the Owner's authorized representative and provided, however, the Construction Manager and Architect shall have the authority to act on behalf of the Owner with respect to providing notification, administering or enforcing the Contract Documents.

§ 2.1.2 Intentionally deleted.

§ 2.2 Evidence of the Owner's Financial Arrangements

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§ 2.2.1 Intentionally deleted.

§ 2.2.2 Intentionally deleted.

§ 2.2.3 Intentionally deleted.

§ 2.2.4 Intentionally deleted.

§ 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 The Owner shall retain a construction manager adviser lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.4 If the employment of the Construction Manager or Architect terminates, the Owner shall employ a successor construction manager or architect to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Construction Manager or Architect, respectively.

§ 2.3.5 The Owner shall not be responsible for furnishing surveys or other information as to the physical characteristics, legal limitations of, or utility locations for the site of the Project. The Contractor shall confirm the location of each utility, shall excavate and dispose of each on-site utility, and shall cap each off-site utility as required by the Work and as may be included in the Contract Documents. The Contractor represents that it is familiar with the Project site and has received all information it needs concerning the condition of the Project site. The Contractor represents that it has inspected the location of the Work and has satisfied itself as to the condition thereof, including, but not limited to, all structural, surface, and reasonably ascertainable subsurface conditions. Based upon the foregoing inspections, understandings, agreements and acknowledgments, the Contractor agrees and acknowledges: (1) that the Contract Sum is just and reasonable compensation for all Work, including, without limitation, foreseen and foreseeable risks, hazards and difficulties in connection therewith, and (2) that the Contract Time is adequate for the performance of the Work. The Contractor shall have no claims for surface or reasonably ascertainable subsurface conditions encountered. The Contractor shall exercise special care in executing subsurface Work in proximity of known subsurface utilities, improvements, and easements.

§ 2.3.6 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.

§ 2.3.7 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.

§ 2.3.8 The Owner shall forward all communications to the Contractor through the Construction Manager and shall also provide the same communications to the Architect about matters arising out of or relating to the Contract Documents. Other communication shall be made as set forth in Section 4.2.6.

§ 2.3.9 The Contractor shall confirm the location of all utilities on the site prior to the commencement of any Work on site. To the extent required for the execution of the Work, the Contractor shall provide all temporary or permanent connections, terminations, removal, or alterations of the utility services to the site. Individual responsibilities of the separate Prime Contractors are delineated further in the Specifications.

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§ 2.3.10 The Owner will provide such test borings and information that it has as to the existing subsurface conditions and site geology. The Owner does not assume any responsibility whatsoever with respect to sufficiency or accuracy of borings made, or of the logs of test borings, or of other investigations, or of the interpretations made thereof, and there is no warranty or guarantee, express or implied, that the conditions indicated by such investigations, borings, logs, or other information are representative of those existing throughout the Project site. There is no warranty or guarantee, express or implied, that unforeseen developments may not occur.

§ 2.3.11 The Contractor acknowledges that it has inspected the site and familiarized itself with visible, observable, and reasonably ascertainable conditions. The Contractor shall have no claim arising from conditions that were reasonably discoverable prior to bid. Concealed or unknown conditions shall be governed exclusively by Section 3.7.4. Geotechnical reports are provided for information only and do not relieve the Contractor of its obligation to perform its own investigation of the site.

§ 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 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. Upon notice from the Owner, the Contractor shall resume performing such Work. This right shall be in addition to and not in restriction or derogation of the Owner's rights under Article 14 hereof. The Owner's right to stop the Work shall not relieve the Contractor of any of its responsibilities and obligations under or pursuant to the Contract Documents.

§ 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 or fails to adequately staff the Project with the proper management, supervision, materials and workforce, including its duty to proceed expeditiously with adequate forces so as to maintain the Project schedule, achieve the Project milestones, and substantial completion, and fails within a 72 hours 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.. Notwithstanding the above, Owner shall not be required to comply with the notice provisions hereof and may proceed to correct such default and neglect if Contractor fails to, within a 24-hour period after receipt of written notice from the Owner, commence and continue correction of such default and neglect where further delay would cause disruption to the Project schedule. Owner shall have the further right to carry out work without any prior notice to Contractor, in an emergency affecting safety of persons or property, and said work is necessary to prevent threatened damage, injury or loss. The right of the Owner to carry out the Work pursuant to this Section 2.5 shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. The Owner's rights set forth in Sections 2.4 and 2.5 hereof shall be in addition to all other rights of the Owner granted in the Contract Documents, at law, or in equity. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including, but not limited to, Owner's expenses, attorneys' fees and compensation for the Construction Manager's and Architect's and their respective consultants' additional services made necessary by such default, neglect, or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect, after consultation with the Construction Manager. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

§ 2.6 Limitation of Responsibility

In no event shall the Owner, Construction Manager, and Architect have control over, charge of, or any responsibility for construction means, methods, techniques, sequences, or procedures or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents. Hence, the Owner and Contractor hereby acknowledge and agree that the Owner has retained the Contractor as an independent contractor to perform the Work on the Project. It is expressly understood and agreed that the presence on the jobsite of the Owner's visiting officers or employees, the Owner, Architect, Construction Manager, or supervisory personnel employed by Owner, and the making by such personnel of any inspections of the Contractor's Work, materials, tools or equipment, or of the finished Work of the Contractor and their approval of same, or failure to take exception thereto, shall in no way relieve the Contractor from its absolute responsibility to perform its Work and furnish its materials in accord with the requirements of the Contract Documents. Any failure by

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the Owner or Architect to take exception to any Work of the Contractor shall not constitute a ratification or approval of the Work or work methods employed by the Contractor if the same did not in fact comply with the requirements of the Contract Documents.

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 by applicable laws 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 Where the term "Contractor" is modified in any way, such as, without limit, "this Contractor", "Plumbing Contractor", "HVAC Contractor" or "Mechanical Contractor", "General Contractor", "Electrical Contractor", the modified term shall be deemed to refer to the Prime Contractor, but such meaning does not relieve the Contractor from his responsibility for all Work, whether or not such Work is sublet or subcontracted. The Contractor shall perform the Work in strict accordance with the Contract Documents. The plural term "Prime Contractors" or "Multiple Prime Contractors" refers to persons or entities who perform construction under contracts with the Owner that are administered by the Construction Manager and Architect. The term does not include the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.

§ 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 Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor. The Contractor shall be responsible for the coordination of its Work with the other Prime Contractors. The Owner, Architect and its consultants, and the Construction Manager and its consultants, shall not be responsible for coordination of the Contractor's Work.

§ 3.1.4 The General Contractor is designated as the Project Coordinator for this Project unless noted otherwise. See all of Articles 3 and 6 for additional information.

§ 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 The Contractor shall carefully study and compare the Drawings, Specifications, Addendum, and other Contract Documents relative to the Work, , shall take field measurements of any existing conditions related to the Work, and shall observe any conditions at the Project site affecting the Work. Any design errors, omissions, or inconsistencies noted by the Contractor shall promptly be reported to the Construction Manager and Architect. Contractor acknowledges that the Contract Documents are full and complete, are sufficient to have enabled it to determine the Contract Sum and that the Drawings, the Specifications and all Addenda are sufficient to enable such Contractor to construct the Work outlined therein in accordance with applicable laws, statutes, ordinances, codes, building codes and regulations of any local, state, federal or any other governmental agency, and otherwise to fulfill all of its obligations under the Contract Documents.

§ 3.2.2.1 Except as to any reported errors, inconsistencies or omissions that have been acknowledged and corrected by the Architect and Construction Manager via Addendum, and to concealed or unknown conditions defined in Section 3.7.4 by executing the Agreement, the Contractor represents the following:

.1 The Contract Documents are sufficiently complete and detailed for the Contractor to: (1) perform the Work required and to produce the results intended by the Contract Documents; and (2) comply with all requirements of the Contract Documents.

.2 The Work required by the Contract Documents, including, but not limited to, all construction details, construction means, methods, procedures, and techniques necessary to perform the Work, use of materials, selection of equipment, and requirements of product manufacturers are consistent with: (1) good and sound practices within the construction industry; (2) generally prevailing and accepted industry standards applicable to Work; (3) requirements of any warranties applicable to the Work; and

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(4) all laws, statutes, ordinances, regulations, rules, orders, codes, and building codes of any state, federal or any other governmental agency which bear upon Contractor's performance of the Work.

§ 3.2.3 The Contractor shall satisfy itself as to the accuracy of all dimensions and locations. In all cases of interconnection of its Work with existing or other Work, the Contractor shall verify at the site all dimensions relating to such existing or other Work. Any errors due to the Contractor's failure to verify all such locations or dimensions shall be promptly rectified by the Contractor without any additional cost to the Owner.

§ 3.2.3.1 Measurement

Before ordering any materials or doing any Work, each Contractor and each Subcontractor shall verify measurements at the Project site and shall be responsible for the correctness of such measurements. No extra charge by the Prime Contractors or compensation to the Prime Contractors will be allowed on account of differences between actual dimensions and the dimensions indicated on the Drawings. Any difference which may be found shall be submitted by the Prime Contractor to the Architect in writing for resolution before proceeding with the Work.

§ 3.2.3.2 Prior to proceeding with any Work, and in sufficient time as not to delay the Work, the Contractor shall:

.1 Review, compare and analyze the Contract Documents and any information or surveys provided by the Owner; and

.2 Inspect and check such portion of the Work for proper fit and matching with continuous Work and for proper coordination with other Work and the Work of the Owner or of Separate Contractors; and

.3 Verify all dimensions and measurements with actual field conditions at the Project.

§ 3.2.3.3 The Contractor shall immediately notify the Owner, Construction Manager, and Architect of any errors, omissions or inconsistencies noted as the result of the Contractor's activities under Section 3.2.3 as a request for information submitted to Construction Manager in such form as the Construction Manager and Architect may require. If the Contractor knows or reasonably should know of any such error, omission or inconsistency and proceeds with the construction in question without first giving such notice, any claim for an adjustment to the Contract Sum or the Contract Time shall be deemed waived and released and the Contractor and its Surety shall assume all responsibility and liability on a joint and several basis for such performance and shall indemnify the Owner for all costs, expenses, losses and damages incurred by the Owner, including, but not limited to, legal fees, costs, and expenses, incurred by the Owner as the result thereof, including any cost to repair, correct or rework the construction in question.

§ 3.2.4 If the Contractor believes that additional cost or time will be required as a direct result 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 and its sub-Sections, 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 and its sub-Sections, 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.

§ 3.2.5 The Contractor shall review the drawings and the Work of others to determine if that Work affects the Contractor's planned Work and also to coordinate and schedule all required Work.

§ 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, the Construction Manager, and the Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Contractor shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance

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of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.1.1 No alleged verbal agreement or conversation with any officer, agent or employee of the Owner, Construction Manager or Architect, either before or after the execution of the Contract, shall affect or modify the terms or obligations herein contained. Failure to comply with any or all of the requirements of this Section 3.3 will not relieve the Contractor from the responsibility of properly estimating the difficulty or cost of successful completion of the Work, nor from the responsibility for the faithful performance of the provisions of this Contract. Modifications or changes may be made in writing only. This requirement may not be waived under any circumstances.

§ 3.3.1.2 When more than one major phase is being constructed at different locations of the Project site, supervision must be assigned to each phase when Work of that Agreement is being performed. When performing construction Work to maintain the progress schedule requires extended hours, multiple shifts, and/or additional workdays, adequate supervision shall be required during these times. The competence level and ability of supervisory personnel must be adequate to perform the construction activities involved.

§ 3.3.1.3 Although these various second level supervision personnel may be reassigned from time to time, the Contractor shall retain one superintendent with full responsibility while performing Work on the Project. Article 3.9 of these General Conditions contains the full requirements for Contractor's Superintendent and Project Manager.

§ 3.3.1.4 The Contractor, his employees or his subcontractors shall not install any product or equipment in a manner that is in direct conflict with the manufacturer's recommended requirements. If the manufacturer of the product or equipment has requirements that cannot be met by the specific application indicated, the Contractor shall bring this information to the attention of the Architect. Products or equipment that are 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.

§ 3.3.1.5 The Project involves numerous complex plumbing, mechanical, electrical, and general construction installations, Contractor's representatives shall be sufficiently familiar with these trades to provide intelligent and efficient supervision, coordination and scheduling through all phases of work.

§ 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 not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

§ 3.3.3.1 A Prime Contractor's failure to perform their Work or whose negligence in performing their Work impacts other Prime Contractors or Separate Contractors shall be responsible for costs or damages incurred by the other contractors that are necessary to maintain the Project Schedule. Prime Contractors shall be responsible for costs or damages incurred by Owner and the other Contractors, including but not limited to attorney fees and additional compensation of Construction Manager and Architect.

§ 3.3.3.2 The Contractor has reviewed the substantial completion dates and times for each milestone, phase and the entire Work of the Project set forth in the Contract Documents, agrees that such dates and times are reasonable and commits to achieve them. The Contract Sum includes costs associated with completion by those dates and times, including, but not limited to, costs associated with out-of-sequence work, come-back work, stand-by work, stacking of trades, coordination with the schedules and work of other Prime and separate contractors, allowing sufficient time, work and storage areas, and site access for other Prime and separate contractors to timely progress and complete their work, and overtime, expediting, and acceleration that may be required to complete the Work by those dates and times.

§ 3.3.4 The General Contractor is designated as the Project Coordinator for this Project. The Project Coordinator and other Prime Contractors are responsible for coordination of the Work. The Project Coordinator is responsible for making all coordination decisions not mutually agreed to by all affected Prime Contractors. Disputes between or among the Project Coordinator and one or more other Prime Contractors and disputes in connection with the

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construction schedule, the furnishing of additional resources to meet the project schedule, job coordination and all aspects of the means and methods of construction shall be submitted promptly to the Project Coordinator for a final construction decision. The Project Coordinator and the affected Prime Contractor or Contractors shall in connection with all submissions for a final construction decision provide actual written notice contemporaneously to the Construction Manager, Architect, and the Owner. The final construction decision of the Project Coordinator must, at all times, be consistent with content and intent of the Contract Documents and the latest accepted schedule and shall be subject to review and approval, rejection, or modification by the Construction Manager. The final construction decision of the Project Coordinator, as approved or modified by the Construction Manager, will be observed, accepted, and fully followed by all Prime Contractors and their Subcontractors on the project, subject only to the dispute resolution procedures set forth in Article 6 of these General Conditions. The progress of the Work in accordance with the final construction decision of the Project Coordinator, as approved or modified by the Construction Manager, shall not be delayed pending any such dispute resolution proceedings.

§ 3.3.5 The schedule of any Work affecting existing installations or facilities shall be coordinated with the other consultants, Owner and Construction Manager. At no time shall any of the Work or operations leading to Work defined in the Contract Documents interfere in any way with the Owner's day-to-day activities, service of power, light, heat, water, telephone, utilities, etc., which shall be maintained. Shutdown of utilities or equipment affecting existing operations will not be permitted except as provided below. Any premium time or additional cost to comply with these requirements shall be at the expense of the Contractor and shall be included in their bid. No shutdowns of existing installations and facilities, except by special permission, shall be scheduled between 5:00 a.m. and 6:00 p.m. All required shutdowns shall be during nights with the prior written approval of the Owner.

§ 3.3.6 Each Prime Contractor shall be responsible for the intermeshing of various other contracts and their own Work, so that no part will be left in an unfinished condition owing to disagreement among the various Prime Contractors as to where the Work of one begins and ends with reference to the Work of another. Prime Contractor shall deliver a fully completed Project to the Owner.

§ 3.3.7 Hierarchy of Coordination Authority.

Each Prime Contractor shall remain solely responsible for coordinating its own Work with the Work of other Prime Contractors, Separate Contractors, and the Owner's forces. Where a General Contractor is designated as the Project Coordinator, the Project Coordinator shall have authority to resolve coordination conflicts among Prime Contractors related to sequencing, interfacing, and logistical alignment of the Work.

The Construction Manager's involvement in coordination shall be limited to review of coordination decisions for consistency with the Project Schedule and the Contract Documents. Nothing herein shall be construed to assign responsibility to the Construction Manager or Architect for construction means, methods, techniques, sequences, procedures, or safety programs, nor to alter the allocation of responsibility otherwise established in the Contract Documents.

§ 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.

§ 3.4.1.1 Not later than 10 days from the Contract Date, the Contractor shall provide a list of all products proposed for installation, including the name of the manufacturer of each for approval by the Owner and Architect. The list shall be tabulated by, and be complete for, each Specification Section. Where applicable, subcontractor's names shall be included in such list. Only those materials specified in the Contract Documents or approved by Addendum may be used in construction.

§ 3.4.1.2 Any material specified by reference to the number, symbol, or title of a specified standard, such as a Commercial Standard, a Federal Specification, a trade association standard, or other similar standard, shall comply with the requirements in the latest revision thereof, and any amendment or supplement thereto in effect on the date of submission of the Bid, except as limited to type, class or grade, or modified in such reference. The standards referred

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to, except as modified in the Specifications, shall have full force and effect as though printed in full in the Specification.

§ 3.4.1.3 The specific mention of a manufacturer's name, brand of material, equipment, etc., shall be considered as indicating a standard of quality, grade or type desired. Materials of manufacturers other than those mentioned throughout the specifications may be accepted if they are equal in quality and performance to those specified **and** written approval is given by the Architect prior to bid. Any other substitution request procedures are further defined in the Contract Documents.

§ 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, in consultation with the Construction Manager, and in accordance with a Change Order or Construction Change Directive. After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in Specification Section 01 60 00 Product Requirements.
(Paragraph deleted)

§ 3.4.2.1 If the Contractor makes a request for substitution, such request shall be deemed to be Contractor's:

- **.1** Representation that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to the specified product.
- **.2** Representation that the Contractor will provide the same warranty for the substituted product that the Contractor would for the specified product.
- **.3** Certification that the cost data presented is complete and includes all related costs under this Agreement except the Architect's redesign costs and waives all claims for additional cost related to the substitution which subsequently become apparent.
- **.4** Representation that it will coordinate the installation of the accepted substitute product and make such changes as may be required for the Work to be complete in all respects without additional cost to the Owner.
- **.5** Representation that the use of the substituted product will not have an adverse effect on any other trade or the construction schedule. However, to the extent that the incorporation of a substituted item or assembly into the Work will require revisions or additions to the Work of other construction contracts, the Contractor proposing to use such substituted materials, products, or assembly represents that it will bear the cost of such revisions or additions for all applicable trades of Work at no change in the Contract Sum.

§ 3.4.3 Contract Sum Not Adjusted for Rising Costs: With the exception of price increases or rebates as set forth in Specification 01 29 01 related to asphalt paving costs and the Asphalt Cement Price Index for PennDOT Zone 1, District 6, the Bid (and hence the Contract Sum) for the Contract must be guaranteed for the duration of this Project and shall thereby have incorporated within it any or all escalation factors related to market conditions. Notwithstanding any other provision in the Contract Documents to the contrary, Contractor's Contract Sum is intended to include all increases in cost, foreseen or unforeseen, including, without limitation, increases in costs arising from supply shortages, unusual delay in deliveries, increases in market prices for materials, labor, taxes and/or other causes beyond the Owner's control, all of which are to be borne solely by the applicable Contractor supplying the materials and/or labor to the Project. All loss and/or damage arising from any of the Work performed under this Agreement through unforeseen or unusual obstructions, difficulties or delays which may be encountered in the prosecution of same shall be borne solely by the applicable Contractor prosecuting the Work.

§ 3.4.4 Overtime: Any work necessary to be performed after regular working hours, on Sunday or Legal Holidays, shall be performed without additional expense to the Owner.

§ 3.4.5 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. The Owner specifically reserves the right to reject any person the Owner deems unfit or unsuitable to be permitted on the Project Property. Upon written notice or verbal direction from the Owner or Construction Manager, the Contractor shall have all such persons removed from the Project. Obscene language, excessive noise, loitering, unauthorized use of kitchen facilities, smoking and possession, use or being under the influence of alcohol or a controlled substance, etc., will not be tolerated. The Contractor, its employees, subcontractors

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and suppliers are required to act in a professional and orderly manner when on and around the District property. Owner's right to declare such person unfit shall not be limited to the required exclusion of persons from Project site as set forth in Section 1-111 of the Pennsylvania Public School Code and/or Subchapter C.2 of the Child Protective Services Law.

§ 3.4.5.1 Competent Workmen: No person shall be employed to do Work under the Contract except competent and first-class workmen and mechanics.

§ 3.4.5.2 Contractors' personnel shall not make any remarks to any students or Owner's personnel that violate decency or cause embarrassment to that individual or the Owner. Failure to comply will result in dismissal from the Project.

§ 3.4.5.3 The Contractor shall abide by the following requirements, which shall apply to all Contractors, all Subcontractors of any tier, and all employees of all Contractors and all Subcontractors of any tier:

.1 They shall not socialize with the students, faculty, visitors, or patrons.

.2 They are prohibited from smoking, vaping, and other use of tobacco in buildings and on the grounds owned by or under the control of the Owner. Workers shall not smoke or use vaping devices within the limits of the Owner's property boundaries or as otherwise required by Federal legislation, Title X, P.L. 103-227, Goal 2000, Educate America Act of 1994 as amended from time to time, including without limitation, 20 U.S.C.A. Section 6081, et seq., the Pro-Children Act of 1994. Workers shall not possess or consume alcoholic beverages when within the limits of the Owner's property boundaries. The Contractor shall require its employees and agents, and its Subcontractor's employees and agents to work diligently and behave in an orderly manner at all times when at or about the Project site and shall remove from the Project any employee whose conduct is deemed objectionable. Unless otherwise approved by the Owner, persons performing Work shall not use the Owner's building facilities, including, without limitation, restroom facilities.

.3 They are not allowed to use the existing facilities, i.e., lunchroom, toilets, etc., unless specifically stated otherwise in these Contract Documents.

.4 They are not allowed in the existing facility except in areas being renovated.

.5 They shall not use radios on the site for music or entertainment purposes.

.6 They shall not possess, or consume, or be under the influence of alcoholic beverages when on site.

.7 They shall not use, possess, or be under the influence of any illegal substances (i.e., drugs, etc.) while on site.

Failure to comply with the above requirements may result in the Owner requiring the offending party to be removed from the Project and not allowed to return.

§ 3.4.6 CRIMINAL HISTORY AND CHILD PROTECTIVE SERVICES INFORMATION

.1 Prior to commencing Work, the Contractor and each Subcontractor shall submit on the prescribed form for each employee or person performing work at the Project site on behalf on the Contractor and Subcontractor prior to such person performing any work, a complete:

a. Original Pennsylvania and federal criminal background checks in accordance with Section 111 of the Public School Code of 1949, Act 34 of March 10, 1949, P.L. 30, No. 14, as amended by from time to time including, without limitation, by Act 114 of July 11, 2006, P.L. 1092, and Act 24 of 2011 (P.L. 112, No. 24) (24 P.S. Section 1-111, et seq.), both dated no older than sixty (60) months prior to the date presented to the Owner.

b. Official clearance statement obtained from the Pennsylvania Department of Public Welfare pursuant to Act 151 of December 16, 1994 (P.L. 1292), subchapter C.2 of the Child Protective Services Law, as amended from time to time, dated no older than sixty (60) months prior to the date presented to the Owner.

.c The "Commonwealth of Pennsylvania Sexual Misconduct/Abuse Disclosure Release", that has been developed by the Pennsylvania Department of Education, pursuant to Act 168 of 2014, to be used by school entities and independent contractors of school entities and by applicants who would be employed by or in a school entity in a position involving direct contact with children to satisfy the Act's requirement of providing information related to abuse or sexual misconduct.

.d Properly completed and executed Form PDE-6004. The Contractor and its subcontractors shall refuse to employ any person as an independent contractor or employee whose Federal Criminal History record information indicates that such prospective employee has been convicted within

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5 years immediately preceding the date of the report of any of the following offenses: (1) An offense under one (1) or more of the provisions of Title 18 of the Pennsylvania Consolidated Statutes, (2) An offense designated as a felony under the act of April 14, 1972 (P.L. 233, No. 64), known as "The Controlled Substance, Drug, Device and Cosmetic Act"; and (3) an out-of-State or Federal offense similar in nature to those crimes listed on Form PDE-6004; and

.e Any such other clearances as may be required by law.

.2 Owner shall review the submissions prior to each individual being permitted to come onto the Owner's property. The Owner reserves the right to reject any employee, agent, or subcontractor that the Owner determines in its sole discretion has an unsatisfactory criminal history or child abuse clearance. The Owner shall retain a copy of all such clearances in its file. Notwithstanding any other provision of this Contract, violation of this provision shall constitute grounds for immediate termination of the Contract by the Owner. Any individual rejected by the Owner shall not be permitted on the Owner's property. Owner's right to declare such person unfit shall not be limited to the required exclusion of persons from direct contact with children as set forth in Section 1-111 of the Pennsylvania Public School code and/or subchapter C.2 of the Child Protective Services Law.

.3 The Contractor shall notify the Owner in writing within seventy-two (72) hours if any person working on the Project under the Contractor's supervision (employee, agent, Subcontractor, Subcontractor's employee, etc.) is arrested or convicted of offense listed in 24 P.S. §1-111.1, or has an indicated or founded report of child abuse.. The Owner shall have the right to prohibit any such individual from coming onto its property.

§ 3.4.7 PUBLIC WORKS EMPLOYMENT VERIFICATION

Only individuals permitted to work in the United States of America, and the Commonwealth of Pennsylvania shall be employed, in any capacity, in the performance of any Work under the Contract. The Contractor shall comply with the provisions of the Public Works Employment Verification Act (the "Act"), including but not limited to, setting forth the following information regarding the Act's requirements in all contracts with Subcontractors:

.1 The Contractor and every Subcontractor performing work under the Contract shall utilize the E-Verify Program (EVP) operated by the United States Department of Homeland Security to electronically verify employment eligibility of each new employee hired after January 1, 2013. The Contractor and each of its Subcontractors shall submit to the Construction Manager a separate and complete Verification Form, executed by a representative who has sufficient knowledge and authority to make the representations and certifications contained in the Verification Form, as required by the Public Works Employment Verification Act, Act No. 141, January 3, 2023 (formerly Senate Bill 637 and Act 127), before performing any Work on the Project.

.2 The Contractor, as precondition of the Contract, shall submit the Public Works Employment Verification Form to the Owner along with its Payment Bond, Performance Bond, Certificates of Insurance and Form Contract.

.3 Every Subcontractor shall submit completed Public Works Employment Verification Form to the Owner prior to performing work on the Project.

.4 During term of the Contract, each new employee hired by the Contractor, regardless of whether employee will be working onsite or offsite of the Project, shall be verified within five (5) business days of his or her start date.

.5 During the Project, new employee hired by Subcontractor, regardless of whether employee will be working onsite or offsite of the Public Work or otherwise, shall be verified within five (5) business days of his or her start date.

.6 Subcontracts between the Contractor and its Subcontractors and between Subcontractors of any tier and their Subcontractors are required to contain notification of applicability of the Act, information regarding use of the EVP and reference to the Departments website at www.dgs.state.pa.us to obtain a copy of the Form.

.7 The Contractor and all Subcontractors shall cooperate with the Department during investigation or audit arising under the Act.

.8 The Contractor and every Subcontractor shall maintain documentation of continued compliance with the Act by utilizing the EVP for new employees hired throughout duration of the Public Work Contract.

§ 3.4.8 CONTRACTOR RESPONSIBILITY PROVISIONS

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.1 The Contractor certifies, for itself and all its Subcontractors, that as of the date of its execution of its Bid and the Contract, that neither the Contractor, nor any Subcontractors, nor any suppliers, are under suspension or debarment by the Commonwealth of Pennsylvania or any governmental entity, instrumentality, or authority and, if the Contractor cannot so certify, then it agrees to submit, along with its Bid, a written explanation of why such certification cannot be made.

.2 The Contractor also certifies, that as of the date of its execution of its Bid and the Contract, it has no tax liabilities or Commonwealth of Pennsylvania obligations.

.3 The Contractor's obligations pursuant to these provisions are ongoing from and after the effective date of the Contract through the termination date thereof. Accordingly, the Contractor shall have an obligation to inform the Owner if, at any time during the term of the Contract, it becomes delinquent in the payment of taxes, or other Commonwealth of Pennsylvania obligations, or if it or any of its Subcontractors are suspended or debarred by the Commonwealth of Pennsylvania, the federal government, or any other state or governmental entity. Such notification shall be made within 7 days of the date of suspension or debarment.

.4 The failure of the Contractor to notify the Owner of its suspension or debarment by the Commonwealth of Pennsylvania, any other state, or the federal government shall constitute an event of default of the Contract with the Owner.

.5 The Contractor agrees to reimburse the Owner for the reasonable costs of investigation incurred by the Owner for investigations of the Contractor's compliance with the terms of this or any other agreement between the Contractor and the Owner. Such costs shall include, but shall not be limited to, salaries of investigators, including, without limitation, overtime, travel and lodging expenses, legal fees, professional fees, Architect fees, Construction Management fees, expert witness fees, documentary fees and all other costs and expenses related thereto.

.6 The Contractor may obtain a current list of suspended and debarred Commonwealth of Pennsylvania Contractors by either searching the internet at http://www.dgs.state.pa.us/ or contacting the:

Department of General Services
Office of Chief Counsel
603 North Office Building
Harrisburg, PA 17125
Telephone No.: 717-787-6472
FAX No.: 717-787-9138

.7 Without being limited by the specificity of any requirements in the Contract Documents, the Contractor shall strictly comply with all applicable laws, ordinances, rules, orders, mandatory guidance, and regulations of all authorities having jurisdiction over the Project.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner, Construction Manager, 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 Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. The warranty provided in this Section shall be in addition to and not in limitation of any other warranty required by the Contract Documents or otherwise prescribed by law.

§ 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.

§ 3.5.3 The Contractor hereby guarantees the Work to the full extent provided in the Drawings, Specifications, these General Conditions, and other Contract Documents. Materials and workmanship shall be guaranteed for a minimum of one (1) year from the date of Substantial Completion for the entire Project, except where a longer period is specified. The Contractor shall make good without cost to the Owner for any defective portion of the Work, including other Work damaged thereby, within seventy-two (72) hours of being notified of the defective work. Owner's rights

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and remedies hereunder shall be in addition to any other rights and remedies which the Owner may have pursuant to law, equity or other portions of the Contract Documents. Without limitation by the foregoing, the Contractor shall pay in addition for all damage to the Project resulting from defects in the Work and all costs and expenses necessary to correct, remove, replace and/or repair the Work and any other work or property which may be damaged in correcting, removing, replacing, or repairing the Work, as well as any consequential damages the Owner may suffer. If the Contractor fails to adhere to this provision, the Owner will be entitled to, in seeking to enforce its rights, recover, legal fees, consultant and expert witness fees, or any other expenses incurred by the Owner.

§ 3.5.4 The Contractor shall forward guarantee and warranty registration cards to the manufacturers in the name of the Owner showing the date of acceptable Substantial Completion of the Work as the beginning date for guarantee and warranty periods.

§ 3.6 Taxes

§ 3.6.1 The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof 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. The 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 Act No. 45-1998. No charges for tax 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.

§ 3.6.2 The Contractor hereby accepts and assumes full and exclusive liability for payment of all sales taxes, state and municipal taxes including, without limitation, business privilege taxes, use taxes, and all contributions and payroll taxes under the provisions of Federal law or the laws of the Commonwealth of Pennsylvania, including, but not limited to, Social Security Acts, as to all employees engaged in the performance of the Work subject to this Agreement, and further agrees to meet all requirements that may be specified under regulations of government officials having jurisdiction over the Work. All such taxes are expressly included within the compensation owed to the Contractor under the terms of this Agreement. It is further agreed that the Owner shall have the right to deduct the amount of any and all such taxes from the compensation owed to the Contractor under the terms of this Agreement at any time, in the Owner's sole discretion, as the Owner deems advisable, it being agreed that the Owner shall have the right to deduct any and all such moneys from the next payments due under the Agreement and from the retained percentages.

§ 3.6.3 The Contractor hereby accepts and assumes full and exclusive liability for and shall indemnify, defend, protect, and save harmless the Architect, Construction Manager and Owner from and against the payment of:

.1 All contributions, taxes or premiums (including, without limitation, interest and penalties thereon) which may be payable under any unemployment insurance laws of any state, the Older Workers Benefit Protection Act of 1990 (OWBPA) (P.L. 101-433, October 16, 1990, 104 Stat. 978), as amended from time to time, the Federal Social Security Act, as amended from time to time, Federal, State, County and/or Municipal tax withholding laws, or any other laws, measured upon the payroll of or required to be withheld from employees, by whomever employed, engaged in the Work.

.2 All sales, use, personal property and other taxes (including, without limitation, interest and penalties thereon) required by any Federal, State, County, Municipal or any other laws to be paid or collected by the Contractor or any of its Subcontractors or vendors or any other person acting for, through or under it or any of them by reason of the performance of the Work or the acquisition, ownership, furnishing or use of any materials, equipment, supplies, labor, services or other items for or in connection with the Work.

.3 All pension, welfare, vacation, annuity and other employee and union benefit contributions payable under or in connection with labor agreements with respect to all persons, by whomsoever employed, engaged in the Work.

.4 In the event that any law is or has been passed, or any rule or regulation pursuant thereof is enacted, which requires the Owner to pay, either directly or indirectly, the amount of any such sales, use, personal property and other taxes (including, without limitation, interest and penalties thereon) required by any Federal, State, County, Municipal or any other laws or should any such law, rule or

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regulation direct the Owner to collect the same, or make the Owner liable for the collection thereof, or make the Owner responsible therefor, it is covenanted and agreed that the Contractor shall fully and completely make all payments therefor, and shall fully and completely indemnify and save the Owner harmless from any and all such taxes.

§ 3.6.4 The Contractor shall base its Bid on the properly charged, collected, and remitted sales tax due on only those "construction activities" which are presumed to become a permanent part of the real estate in accordance with 61 Pa. Code Section 31.11, et seq., as amended from time to time. The Contractor has not included in its Bid any tax for "sales activities" which do not become a permanent part of the real estate in accordance with 61 Pa. Code Section 31.11, et seq., as amended from time to time.

§ 3.6.4.1 The Contractor shall preserve all such records for a period of three (3) years, or for such longer period as may be required by law, after final payment. To the extent requested by Owner, copies of such records will be provided by the Contractor, and the Contractor shall immediately transmit to the Owner copies of all invoices and receipts for materials, equipment, and labor furnished in connection with the Work by the Contractor and any other materials that reflect sales and use tax paid or not paid.

§ 3.6.4.2 The Contractor agrees to assign and transfer to the Owner all of its rights to sales and use tax which may be refunded as a result of a claim for refund for materials and/or equipment purchased for the Project. 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. This assignment will include, without limitation, any tax erroneously paid by the Contractor. Further, the Contractor agrees to execute all such documents as may be necessary to effectuate such an assignment.

§ 3.6.5 The Contractor shall keep detailed records of all materials, equipment, and labor furnished in connection with the Work and shall keep such full and detailed accounts as may be necessary for the proper financial management under this Agreement and the system utilized by the Contractor shall be satisfactory to the Owner. The Owner or its representative shall be afforded access to the Contractor's records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, certifications, and similar data relating to this Agreement. Further, the Contractor must provide the Owner with certified payroll records in compliance with Section 16.3 for the labor furnished by the Contractor in connection with the Work. Contractor shall, at no additional charge to Owner, provide all necessary information and participate in any audits conducted on the Project, both during and after its completion, at the request of the Owner.

§ 3.6.5.1 Contractor shall require all of its Subcontractors to preserve and make their records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, certifications, and similar data relating to the Work for a period of three (3) years, from the date of Final Completion or for such longer period as may be required by law, after final payment.

§ 3.7 Permits, Fees, Notices, and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Owner, assisted by the Construction Manager, shall assist with completion of application and payment of Building permit. The Contractor shall be responsible for final completion of the permit applications and coordinating the submission of the permit application. The Contractor shall secure and pay for all necessary administrative costs, insurances, business privilege licenses, certifications, or taxes to apply for the necessary permits required to perform the Work.

The Owner will pay any Sewer, Water, Gas and Electrical Utility Connection Charges.

§ 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. . In any instance where requirements of the Contract Documents are in excess of but not in conflict with or violation of requirements of a public authority, the provisions of the Contract Document shall govern.

§ 3.7.2.1 It is the responsibility of the Contractor to determine what codes and local ordinances, if any, will affect its Work. The Contractor 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, the Contractor shall check for any rules or regulations of other organizations having jurisdiction, including, without limitation, chambers-of-commerce, planning commission, railroads, industries, or utility companies who have jurisdiction over lands which the Contractor

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furnishes materials, equipment and labor in connection with the Work. Any costs of compliance with local controls shall be included in the Contract Sum, even though documents of such local controlling agencies are not listed herein.

§ 3.7.2.2 The Contractor shall comply with all aspects of the Federal Occupational Safety and Health Act of 1970 (O.S.H.A.) including specific responsibilities to perform reporting and recording requirements. The Contractor is responsible to obtain information regarding his responsibilities under the Act.

§ 3.7.2.3 The Contractor shall comply with all aspects of Pennsylvania Act 287 (December 10, 1974), requiring among other things that each Contractor who intends to perform excavation or demolition work in a site within a political subdivision, ascertain the location and type of utility lines and pipes at each site and notifies the utility company(s) three working days in advance of performing the excavation or demolition. Call Pennsylvania One Call System, Inc. (1-800-242-1776). The Contractor shall be responsible for timely notification to and coordination with all utility companies regarding the provision of services to the Project. The Contractor shall inform the Architect at once when the Owner's participation is required, and the Architect shall immediately notify the Owner. Connections for temporary and permanent utilities and payment for temporary utilities services required for the Work, whether the Work is new construction or renovation of an existing facility, are the responsibility of the Contractor unless otherwise agreed. If the Work is new construction, then payment for temporary and/or permanent utility services shall be the responsibility of the Contractor until Substantial Completion.

§ 3.7.2.4 The Contractor at all times shall observe and comply with all Federal and State Laws and local codes, ordinances and regulations in any manner affecting the conduct of work and all such orders or decrees as exist at present and those which may be enacted later by bodies or tribunals having jurisdiction or authority over the Work and shall indemnify, defend, and save harmless the Owner and all his officers, agents and servants against any claim or liability arising from or based on the violation of any such law, code, ordinance, regulations, order or decree, whether by himself or his employees.

§ 3.7.2.5 Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if through mistake or otherwise such provision is not inserted, or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

§ 3.7.2.6 The Contractor shall ensure that products incorporated into, and used to execute, the Work of the Project are free from asbestos and other hazardous materials. If any suspected asbestos-containing material is installed, the Owner has the right to have the material in question tested and if proven to contain asbestos, the Contractor shall remove all material in question and replace it with new acceptable material at no additional cost to the Owner and shall pay for costs associated with testing of the suspected material.

§ 3.7.2.7 Material Shipments: The Contractor in making or ordering shipments shall not consign or have consigned materials, equipment, or any other items in the name of the Construction Manager, Architect, or the Owner. Neither the Construction Manager, Architect or the Owner shall be under any obligation to make payment for charges on shipments made by or to the Contractor.

§ 3.7.3 It shall be the obligation of the Contractor to review the Contract Documents and to determine and to notify the Owner, the Architect, and the Construction Manager of any conflict, inconsistency, or discrepancy between standards, codes, laws, ordinances, building codes and regulations of which the Contractor has knowledge or should be reasonably able to determine. The Contractor shall not violate any zoning, setback or other requirements of applicable laws, codes, standards, regulations and/or ordinances, or of any recorded covenants of which the Contractor has knowledge. If the Contractor observes that portions of the Contract Documents are at variance with applicable laws, statutes, ordinances, building codes, standards, codes, rules or regulations, the Contractor shall notify the Architect and Construction Manager promptly in writing, and necessary changes shall be accomplished by appropriate modification.

§ 3.7.3.1 If the Contractor, any of its Subcontractors or any Sub-Subcontractors, performs Work contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Construction Manager, Architect, and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs, including but not limited, any fines or penalties from governmental authorities and the costs of corrective actions or replacement.

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§ 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 contemporaneously provide notice to the Owner, Construction Manager, and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect and Construction Manager will promptly investigate such conditions and, if the Architect, in consultation with the Construction Manager, determines that the conditions 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, in consultation with the Construction Manager, 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, Construction Manager, and Contractor, stating the reasons. Claims by the Contractor in opposition to such determination must be made within 21 days after the Architect has given notice of the decision. If the Owner or Contractor disputes the Architect's determination or recommendation, either 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, Construction Manager, 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 Time arising from the existence of such remains or features may be made as provided in Article 15. .If Contractor notifies the Owner, Construction Manager, and/or Architect of any of the conditions set forth in this Section, Owner shall have the right, in such event, to terminate the Agreement, and upon payment to Contractor of all sums due as of the date of termination, Owner shall have no further liability or responsibility to Contractor under the Contract Documents.

§ 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.

§ 3.8.2

(Paragraphs deleted)

NO CASH ALLOWANCES are included in the Contract Documents for any purpose.

(Paragraph deleted)

§ 3.9 Superintendent and Project Manager

§ 3.9.1 The Contractor shall employ a competent superintendent, Project Manager, and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent and Project Manager shall represent the Contractor, and communications given to the superintendent or Project Manager shall be as binding as if given to the Contractor. At the request of the Construction Manager, Architect or Owner, the Contractor's superintendent and Project Manager shall attend Project meetings, whether the Project meetings are prior to the start of the Contractor's work or subsequent to the completion of the Contractor's work. The Superintendent shall be on the Project site full time during the progress of the Work until the day of substantial completion and for such additional time thereafter as the Construction Manager may determine to be necessary for the expeditious completion of Work. Communications shall be promptly confirmed in writing.

§ 3.9.2 Each Contractor, within ten (10) business days following receipt of Notice to Proceed, shall furnish in writing the Owner and Architect, through the Construction Manager, of the name and qualifications of a proposed superintendent and Project Manager. The proposed personnel shall include at least 3 recent projects of similar contract size and scope, with the names and telephone numbers of Owner and Architect representatives. Within 14 days of receipt of the information, the Construction Manager may notify the Contractor, stating whether the Owner, the

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Construction Manager, or the Architect (1) has reasonable objection to the proposed superintendent or Project Manager, or (2) require additional time for review. Failure of the Construction Manager to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.2.1 The Contractor is to appoint a single representative for both the Superintendent and Project Manager who will be assigned on-site and will designate the same in writing, who has the authority to act on behalf of the Contractor and its Subcontractors and suppliers. Contractor's supervision of Work shall include expediting and coordination of work of trades. Contractor shall perform all supervising and procuring required to ensure delivery of materials to maintain work schedules of sub-contractors and progress schedule of Project to ensure full completion of work, to supply equipment or instruments necessary to complete specified test, checks, balancing of system, to furnish operating instructions, etc.

§ 3.9.2.2 As a consideration of the Contract between the Owner and the Contractor, the Contractor shall retain the same Superintendent and Project Manager for its Work on the Project while on the Project. The Superintendent or Project Manager shall not be reassigned from this Project prior to completion, unless by termination of employment by the Superintendent, Project Manager, or the Contractor, or if required by the Construction Manager or by the Owner in accordance with Section 3.9.3.

§ 3.9.2.3 Contractor's supervision of Work shall include expediting and coordination of Work of trades. Contractor shall perform all supervising and procuring required to ensure delivery of materials to maintain Work schedules of Subcontractors and progress schedule of project to ensure full completion of Work, to supply equipment or instruments necessary to complete specified test, checks, balancing of system, to furnish operating instructions, etc. The outlined work is to be completed in the timeframe set forth in the original project schedule shared with the bidding contractors.

§ 3.9.2.4 Superintendent Timing.
Requirements for submission of superintendent and Project Manager information are administrative in nature. The requirement for on-site presence of the Superintendent and Project Manager shall apply from the commencement of the Work unless otherwise directed in writing by the Construction Manager.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner, Construction Manager, or Architect has made reasonable and timely objection. The Superintendent shall be on site full-time from the initial date as directed by the Construction Manager, which can be reasonably considered the time that Work is commencing onsite. The Contractor shall not change the superintendent without the Owner's and Construction Manager's consent, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in the Contractor's employ. If any Contractor should at any time fail to provide adequate supervision and superintendence, as may be evidenced by incomplete, delayed or non-conforming Work, the Owner may provide supervision and superintendence and the cost thereof, including, but not limited to, compensation for additional professional services, legal fees, or other costs or expenses incurred, shall be charged to the applicable Contractor in the form of a Change Order incorporating an appropriate reduction in the Contract Sum. If the payments due to the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner. The Owner and/or Construction Manager shall have the right to dismiss from the Project any superintendent whose performance is not satisfactory in the sole discretion of the Owner. If during the course of the Project it is evident that the Superintendent is not competent or is not managing the progress of the Project or is not coordinating the various trades, entities, and/or persons under his supervision, then the Construction Manager will document such findings to the Contractor. If within 10 days of receiving such notice, no substantial effort or correction of the finding is made known to the Construction Manager, then the Construction Manager, as requested by the Owner, may require the immediate replacement of the superintendent with an acceptable one at no additional cost to the Owner. The superintendent must be on site for the entire workday. If the superintendent arrives late, leaves early, or is otherwise not present on site for the workday, then the Owner reserves the right to deduct $800.00 per day from the Contract Sum, as liquidated damages and not as a penalty, for each such.

§ 3.9.4 At any time during the Project, the Owner, Architect, and Construction Manager shall have the right and authority, but not the duty, to require the replacement of the Contractor's Project Manager, Superintendent, or Foreman. The Construction Manager shall have the right and authority, but not the duty, to require the Contractor to assign additional supervisory personnel to the Project to ensure compliance with the schedule and quality requirements at no additional cost to the Owner and no increase in the Contract Sum. The Contractor shall not change or replace the assigned superintendent or Project Manager without the prior written consent of the Owner. The

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proposed replacement superintendent or Project Manager is subject to review pursuant to the process outlined in § 3.9.2 prior to acceptance by the Owner and Architect.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall cooperate with the Project Coordinator and prepare and submit for the Architect's information, and the Owner's and Construction Manager's approval, 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, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The schedule shall be revised monthly to reflect the conditions of the Work and Project. The Contractor shall cooperate with the Construction Manager and Project Coordinator in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Multiple Prime Contractors, or the construction or operations of the Owner's own forces or Separate Contractors.

.1 The Contractor's failure to cooperate and participate with the Owner, the Construction Manager, other Prime Contractors and Separate Contractors in the development and review of construction schedules as provided in this Section 3.10 and Specification Section 01 32 00, Construction Progress Documentation, shall be a material breach of its obligations, entitling the Owner to exercise all rights and remedies under the Contract Documents and applicable law. In no event shall any revision to any construction schedule constitute the basis for an adjustment in the Contract Time or the Contract Sum unless such adjustment is agreed to by the Owner and authorized pursuant to Change Order. **Failure of Contractor to fully comply with requirements of this Section 3.10, and the other Contract Documents regarding scheduling shall constitute default by Contractor of its obligations and be sufficient grounds for termination of the Contract**.

.2 The schedules prepared by the Contractor and by the Project Coordinator, if any, under this Article shall be in the form of a CPM arrow network diagram, preferably organized by predecessor and successors and shall include:

(a) A shop drawing and submittal schedule noting the relevant submittal, approval, order, fabrication and delivery durations.

(b) Integration of the shop drawing and submittal schedule with the installation activity logic in order to determine the effect of delivery on installation of any items of Work.

(c) The planned progressions of construction work showing the activities and duration of the Work of each contract phase and clearly noting any interim milestone dates.

(d) The appropriate restraints in order to clearly identify the interrelationships of work and crew and trade flow.

(e) Logic (CPM arrow network) diagrams summarized into a summary bar chart format that is capable of displaying current progress of all Work.

(f) A computerized mathematical analysis of the CPM logic with each monthly schedule responsibility, activity duration, early (target) start date, early (target) finish date, late start date, late finish date, work tasks critical to completion within the Contract Time, and any interim milestone dates.

(g) Crew sizes and planned labor hours for each activity shown on the schedule. Such schedules shall be produced using scheduling software or such other project management program. The Contractor shall deliver to the Owner, upon Owner's request and in the format requested by the Owner, copies of all electronic files (including all schedule logic, restraints and all other electronic data and information used to create and maintain the schedule that the Owner may request) that comprise or relate to such schedules, including the original Project schedule, all schedule updates, any recovery schedules, and any schedule revisions.

.3 The Project Schedule shall be submitted by the Contractor for all Work. All schedule and work items must be in conformance with the Project schedule requirements set forth in the Contract Documents including any phasing or other milestones provided. The Project Coordinator shall incorporate all Contractors' items of Work and issue the Project schedule. Upon written approval of the Project schedule by the Owner and Construction Manager, it shall with respect to time, become the essence of the Contract. The Project schedule may be changed or revised only with the written consent of the

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Construction Manager and Owner. No payment applications will be processed without an approved Project schedule accepted by all Prime Contractors.

.4 The Project Schedule is to be used by the Prime Contractors as a guide, and all Contractors and Sub-contractors shall be responsible to perform Work to ensure that the Project is completed by the Project Contract completion date(s), and all phasing and milestone dates established in the Contract Documents are met. Any claims for additional costs associated with completion of the Work within the required Contract time frames will not be considered. The Contractor and all Sub-contractors, who feel extra time, in any form such as shift work, overtime, and premium time, is necessary to meet Contract requirements regardless of trade, should include these costs in their Bids. All Prime Contractors must recognize that although their Work might not require shift, overtime, or premium timework for completion within the stipulated time frame, it may be required in order to allow other Contractors to complete within the time frame. Prime Contractors must allow for these overtime requirements and include the costs necessary to allow the other contractors to complete within the specified time. Failure to recognize the extra costs in his Bid shall not relieve the Prime Contractor from utilizing shift, overtime, or premium time work in performance of his Contract, and all costs associated with meeting the time frames indicated in the construction schedules shall be included in the Contract Sum. Construction Manager, Architect, and Owner reserve the right to withhold processing of any monthly payment applications from Prime Contractor if schedule compliance is not being strictly adhered to. Such payment may be withheld until the Prime Contractor makes corrective action to comply with Project schedule.

.5 Any preparation, review, enforcement, and updating of the Project schedule does not make Owner, Construction Manager or Architect liable to Contractor for time, cost overruns, or schedule changes which are required to maintain Project Contract completion date and all phasing and milestone dates established in the Contract Documents.

.6 General Scheduling Requirements: Any of the scheduling requirements, including the format, content, and complexity, can be waived, or modified by the sole discretion of the Construction Manager only. Any modification or waiver by the Construction Manager shall not be grounds for any claim by Contractor against Owner, Construction Manager, or Architect. Project Coordinator shall submit final construction schedule and all schedule updates in electronic format with no restrictions for viewing and analyzing using the same software with which the schedule was created. Electronic format shall be submitted to the Construction Manager and to any Contractor that Construction Manager may direct.

.7 The Work under the Contract Documents shall be planned, scheduled, executed, reported, and accomplished using the cost and resource loaded "Critical Path Method" schedule, in calendar days (excluding Saturdays, Sundays and legal holidays). The provisions of the Division 01 General Requirements, and the directions of the Project Coordinator are to be followed by the Contractor in scheduling and coordinating construction activities. The scheduling services of the Project Coordinator are part of its contract with the Owner, but nothing herein relieves the obligations of the Contractor to schedule their own construction activities, and nothing herein alters the obligation of the Contractor to resolve all supervision, coordination, and scheduling issues between and among the Sub-Contractors. In addition, the requirements for subordinate coordination responsibilities and scheduling per the Division 01 General Requirements must be followed by all Prime Contractors.

.8 Contractor is responsible for determining the sequence and logic of activities, the time estimates of the detailed construction activities and the means, methods, techniques, and procedures to be employed with regard to his portion of the Work. The construction schedule shall represent Contractor's best judgment of how he shall prosecute the Work in compliance with the requirements of the Contract Documents. Contractor shall ensure that the construction schedule is current and accurate and is properly and timely monitored, updated, and revised as Project conditions and the Contract Documents may require, and as may be directed by Project Coordinator.

.9 Contractor shall consult with his major Subcontractors relating to the preparation of his construction plan and construction schedule. Major Subcontractors shall receive copies of those portions of Contractor's construction schedule that relates to their Work and shall be continually advised of any updates or revisions to the construction schedule as the Work progresses. When Contractor submits his construction schedule to the Project Coordinator or makes any proposed updates or revisions to such schedule, it shall be concluded by Construction Manager, Owner, and Project Coordinator that Contractor has consulted with and has the concurrence of his major Subcontractors. Contractor shall be solely responsible for ensuring that all Subcontractors comply with the requirements of the construction schedule for their portions of the Work.

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.10 Contractor shall provide the basic data as required by Project Coordinator relating to activities, durations, costs, and sequences as part of Contractor's draft of the Construction Schedule. This data shall reflect Contractor's actual construction plan for the Project and shall fully comply with all requirements of the Contract Documents.

.11 Contractor acknowledges and agrees that his construction schedule must be flexible in order to accommodate and allow for his coordination with all the construction activities and Work of other Prime Contractors, Owner's own forces, and other Separate Contractors.

.12 Review of the Contractor's construction schedule or any other schedule or plan of construction by the Construction Manager, Owner, or Project Coordinator is solely for informational and coordination purposes. Such review shall not constitute approval of, or agreement to, any activity sequence, duration, start date, or finish date shown therein. Nothing in such review shall be deemed to modify the Contract Documents, relieve the Contractor of responsibility for planning and sequencing the Work, or excuse the Contractor from completing the Work in accordance with all milestone, phase, and completion dates set forth in the Contract Documents.

.13 The completion, phasing, and milestone dates set forth in the Contract Documents represent only the major items of Work and may include interface dates with the construction activities of others. Completion, phasing, and milestone dates are Contract requirements and are of the essence to the Contract Documents and to the coordination of the Work by the Contractor. Completion, phasing, and milestone dates represent the latest allowable completion time for those portions of the Work to which each date relates. The dates are not intended to be a complete listing of all Work under the Contract Documents or of all interfaces with Work performed by the Contractors or others. The Contractor shall determine the time requirements for all such interfaces and shall be responsible for planning, scheduling, and coordinating the Work in order to complete in accordance with those requirements.

.14 Review by the Project Coordinator or Construction Manager of Contractor's Construction Schedule, or any revisions or updates thereto, are advisory only and shall not relieve Contractor of the responsibility for accomplishing each portion of the Work within each and every applicable Completion Date. Omissions and errors in the approved or accepted Construction Schedule, or any revisions or updates shall not excuse performance, which is not in compliance with the Contract Documents. Review by the Project Coordinator does not make Owner, Project Coordinator, Construction Manager, or Architect liable to Contractor for time or cost overruns flowing from such omissions or errors.

.15 Should Contractor intend or plan to complete the Work, or any portion thereof, earlier than any applicable completion, phasing, or milestone date or the Contract Time, Contractor shall give timely and reasonable written notice of this fact to the other Prime Contractors, Project Coordinator, and Construction Manager. Project Coordinator shall have the discretion to agree to or reject such early completion plan by Contractor, subject to the rights of Contractor to dispute resolution under the provisions of Article 6 of these General Conditions. The Project Coordinator shall have no duty or obligation to agree to, or to cooperate with Contractor regarding any early completion plan or proposal by Contractor and shall not be liable for any damages of Contractor because of the rejection by Project Coordinator of said plan. Earlier completion of any portion of the Work shall be promoted wherever feasible, and all Contractors must cooperate and accelerate towards earlier completion of any portion of the Work unless such Work affects the quality of work as determined by the Construction Manager. No claims for acceleration to complete early or to meet Project schedule will be considered.

.16 In all respects, Project Coordinator shall cooperate with the Construction Manager in the performance of all duties described in the Contract Documents.

.17 At Construction Manager's sole discretion, if Contractor fails to fulfill their construction scheduling responsibilities in part or in whole, scheduling services may be provided by Construction Manager. Any scheduling services of the Construction Manager actually provided will result in deductions from the Contract Sum of the respective Prime Contractors by Change Order deduct so that the Construction Manager is fully reimbursed for this work, but nothing herein relieves the obligations of the Project Coordinator and other Prime Contractors to schedule and coordinate their own construction activities.

(1) The preliminary Project schedule must be completed within 10 days of Notice to Proceed.
(2) The final Project schedule must be completed within 20 days of approval of Preliminary Project schedule.
(3) Comply with requirements of Section 01 32 00 "Construction Progress Documentation".

.18 If the Contractor does not comply with all the scheduling requirements and timelines, the Owner, upon recommendation from the Construction Manager, reserves the right to deduct as liquidated damages,

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and not as a penalty, $800.00 from the Contract Sum for each day that Contractor does not comply. The Owner may also proceed with enforcing other requirements of the Contract Documents.

.19 Any measures so required or undertaken by the Contractor to maintain the Construction Schedule and to comply with related Section 01 32 00, "Construction Progress Documentation," shall be provided by the Contractor at no additional cost to the Owner.

§ 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 Construction Manager's and Architect's review . The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Construction Manager and 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 cooperate, participate, and consult with other Prime Contractors during the Work of this Project. The Contractor shall make revisions to the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project schedule. The Contractor shall schedule and execute their Work to avoid delay to other Prime Contractors, the Owner's own forces, or other Separate Contractors. The Contractor shall be financially responsible for undue delay they cause to other Prime Contractors, Owner, and Separate Contractors on the Project. The Contractor shall defend and hold harmless the Owner, Construction Manager, and Architect for any claims, losses or delays of any kind whatsoever made by other Prime Contractors or Separate Contractors arising from delays caused by the Contractor.

§ 3.10.4 The Contractor shall promptly perform the Work in accordance with the most recent schedules submitted to the Owner, Construction Manager, and Architect, and incorporated into the approved Project schedule and in such sequence as to cause no delay in the Work or in the activities of other Contractors, Separate Contractors, or the Owner's own forces. The Contractor shall bear all costs and expenses for its delay in failing to meet schedules and milestones for the Project.

§ 3.10.5 The Owner shall have the right to direct a postponement or rescheduling of any date or time for the performance of any part of the Work that may interfere with the operations of other contractors or of the Owner's premises or any of the Owner's operations. The Contractor shall, upon the Owner's request, schedule any portion of the Work affecting other contractors or the operation of the premises during hours when the premises are not in operation. Any postponement, rescheduling, or performance of the Work under this Section 3.10.5 may be grounds for an extension of the Contract Time, if permitted under Section 8.3, but not an increase in the Contract Sum.

§ 3.10.6 Progress payments to the Contractor shall not occur until the Contractor has met the requirements of schedule information stated in this Section 3.10 and the Contract Documents.

§ 3.11 Documents and Samples at the Site

§ 3.11.1 The Contractor shall maintain and make available, at the Project site, one copy of the Contract Documents, including Drawings, Specifications, and Addenda, Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Construction Manager, Architect, and Owner, and delivered to the Construction Manager for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.11.2 The Contractor shall also update the Construction Manager's record set of drawings on a weekly basis, at a minimum, and more frequently as necessitated by the Work. Upon completion of the Work, Contractor shall certify that such record drawings accurately reflect all "as built" conditions for which the Contractor is responsible, after which the Construction Manager will deliver its record drawings to the Architect for submittal to the Owner.

§ 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.

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§ 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 and Construction Manager is subject to the limitations of Sections 4.2.10 through 4.2.12. Informational submittals upon which the Construction Manager and Architect are 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 Construction Manager or Architect without action. Shop drawings submitted prior to issuance of the building permit solely at the Contractor's risk.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Construction Manager, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the Project submittal schedule approved by the Construction Manager and Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Contractors, Separate Contractors, or the Owner's own forces. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples, and similar submittals with related documents submitted by other Prime Contractors.

§ 3.12.5.1 Except where otherwise specified or agreed by Architect, the Contractor shall submit all shop drawings, product data, samples, and similar submittals within ninety (90) days of the Notice to Proceed. When such initial submittals are rejected or otherwise required to be corrected and resubmitted, Contractor shall transmit complying submittals promptly so as to avoid delay in the Work, and in any case within thirty (30) days after return of the initial submittal, unless otherwise agreed by the Architect. Notwithstanding these time requirements for submittals, submittals that are required for work on the critical path of the construction schedule shall be submitted earlier and in a timely manner so as not to delay the Work.

§ 3.12.5.2 The Contractor agrees that the Owner will be damaged in an undeterminable amount if submission of shop drawings, product data, samples, and similar submittals is not made in compliance with Section 3.12.5.1.

§ 3.12.5.3 The Owner reserves the right to deduct $800 per day, as liquidated damages, and not as a penalty, until all such required submittals have been respectively and accordingly transmitted.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner, Construction Manager, 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 reviewed and approved by the Architect. Further, Contractor shall not be entitled to additional costs or time in the event that Contractor orders products or materials prior to receipt of review and approval of the submittal therefor, and which submittal is subsequently rejected or modified by Architect.

§ 3.12.8 The Work shall be in accordance with reviewed/accepted submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's review/acceptance of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Construction Manager and 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

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responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's reviewed/acceptance 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 Construction Manager and 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. Where applicable law and/or the Contract Documents require that Contractor engage a licensed design professional to provide a service, Contractor shall employ a professional possessing the required license in order to perform the service required.

§ 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 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, the Architect, and the Construction Manager 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 accept 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 Construction Manager and Architect at the time and in the form specified by the Architect.

§ 3.12.11 Shop drawings, product data, and samples shall be submitted in quantity and procedures as directed by the Architect. It shall be the responsibility of each Prime Contractor to prepare and furnish to other Prime Contractors engaged on the Project, copies of shop drawings as may be required by such other Prime Contractors for the proper installation of their Work. Failure of the Contractor to furnish such information will make him responsible for any other expenses incurred in carrying out the provisions of such other Prime Contracts.

§ 3.12.12 Under no circumstances shall the Construction Manager, Architect, or Engineer's review of any shop drawing be construed as an approval of extra cost to the Owner for any work shown thereon. Any claim for extra cost shall be made as specified before the time of submitting shop drawings.

§ 3.12.13 All expenses incurred in delivering, transporting, packing, collecting, etc., of samples of materials or equipment shall be paid for by the Contractor, whether samples be delivered to the Project site, to the Architect, or to the laboratory. The cost of mill, fabrication, shop testing, or factory testing and inspection of all material required to be furnished under this Contract shall be borne by the Contractor. Any sample destroyed in the course of testing cannot be returned to the Contractor. Certain approved material, such as hardware, valves, fittings, fire alarm signals, in good condition and not subject to destructive tests, may be used in the Work by the Contractor. This material shall be the last of its particular kind to be incorporated in the building and may not be removed from the Architect's office until just previous to its use. Any material delivered to the job will be compared with the approved sample on file in the Architect's office and if necessary, an additional test shall be made on this material at the cost of the Contractor. Additionally, if a Contractor's shop drawing or other submittal requiring approval of the Architect requires review by the Architect more than three times, then the Contractor shall be responsible to the Owner and the Architect for any costs or expenses associated with reviews beyond the third review.

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§ 3.12.14 To better facilitate the shop drawings process, copies of Floor Plan Backgrounds will be made available in electronic format to all Prime Contractors subject to the following provisions:

.1 The Contractor shall execute and submit the release and indemnification provided and requested by the Architect, Construction Manager, or Consultants. Form is included as Specification Section 01 31 26, Electronic Communication Protocols.

.2 The data contained in any and all electronic files is copyright protected by the Architect and shall be used solely for the facilitation of the shop drawing process on this Project only. Any other use that is not consistent with this intended use is strictly prohibited. Any misuse will be punishable to the fullest extent of the law.

.3 Electronic media will only be made available to Prime Contractors. Direct requests from Subcontractors will not be honored. Prime Contractors shall bear the responsibility of distribution to their Subcontractors, if desired. Requests shall be made in writing directly to the Architect and shall indicate the list of drawings requested (indicate by drawing number). Drawings will be provided in .dwg format and issued electronically.

.4 The Prime Contractor shall thoroughly check all information and details of the Drawings and be satisfied that all information and details are correct. Information concerning existing conditions, if applicable, shall be thoroughly field checked and verified. Incorrect information and details shall immediately be called to the attention of the Architect. **Please note that Addenda information will not be included on the electronic files.** The Prime Contractor shall be responsible for incorporating all pertinent Addenda information.

.5 The Owner, the Construction Manager, the Architect, and the Architect's Consultants shall not be held responsible for any costs or other liabilities resulting from the use of electronic files or the failure of the Prime Contractor to detect errors and omissions concerning matters within his contractual responsibility through the use of said electronic files. The Prime Contractor shall indemnify, defend, and hold harmless, to the fullest extent permitted by law, the Owner, the Construction Manager, the Architect, and the Architect's Consultants, their directors, officers, agents, and employees from and against any and all claims, damages, losses and expenses, including attorney's fees arising out of the modification, misinterpretation, misuse of the electronic files, and for any and all errors or omissions alleged to have arisen out of the use of any electronic files.

.6 Nothing herein contained shall be construed as constituting a guarantee, warranty, or assurance, either expressed or implied, by any party, that the electronic files will yield or accomplish the Prime Contractor's desired outcome.

§ 3.13 Use and Protection of Site

§ 3.13.1 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.

§ 3.13.1.1 If requested by Owner or Construction Manager, Contractor shall move materials from one temporary location shown on the Contract Documents to another, at the sole expense of Contractor, except that expense shall be borne by Owner when Owner requires that materials be moved from a location on the Contract Documents previously assigned to Contractor by Owner. No advertising signs or flags of any nature shall be placed at or near the site, without the written consent of Owner. Owner may make use of any portions of the Work for which a Certificate of Substantial Completion has been accepted in writing by Owner and Contractor.

§ 3.13.2 The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site. The Work shall be conducted so as not to impede traffic nor obstruct any thoroughfare or access to property, and so as not to interfere with the Work of other contractors or with the Owner's continued occupancy and operation of the property. All deliveries shall be coordinated around hours directed by the Owner.

§ 3.13.3 Only materials and equipment which are to be used directly in the Work may be brought to and stored on the Project site by the Contractor. Materials or equipment no longer required for the Work shall be promptly removed from the Project site. Protection of construction materials and equipment stored at the Project site from weather, theft, damage or all other adversity is solely the responsibility of the Contractor, and the Owner shall have no liability therefore.

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§ 3.13.4 During the progress of the Work, the Contractor shall provide lights, barriers, warning signs or other prudent precautions as may be necessary to protect persons and property from the Work performed by the Contractor.

§ 3.13.5 The Contractor shall protect the Owner's property, all surrounding public and private properties, the Contractor's Work in place, and all the Work of Separate Contractors of other Prime Contractors against damage, injury or loss arising in connection with the Contractor's Work.

§ 3.13.6 The Contractor shall, at all times, provide adequate protection of the Work against all kinds of weather so as to maintain all Work, apparatus and fixtures free from injury or damage. At the end of each day's work, all new work subject to potential damage shall be completely covered.

§ 3.13.7 The Contractor shall maintain all passageways, guard fences, lights, fire watch, and other facilities for protection necessary for compliance with applicable laws or otherwise required by authorities have jurisdiction.

§ 3.13.8 To the extent the Contractor is responsible for damage to any existing improvements or vegetation, including, without limitation, curbs, sewers, utilities, sidewalks, drainpipes, structures, lawns, shrubbery, trees, landscaping, hardscaping or other improvements at the site, the Contractor shall repair, restore or replace such damaged improvements or vegetation to the Owner's reasonable satisfaction.

§ 3.13.9 In case any direct or indirect injury is done to existing street or underground structure, sewers, mains, or to public or private property of any kind, or to any materials or fixtures, by or because of the Work in consequence of any act or omission on the part of the Contractor, his employees, or agents, the Contractor, at his own cost and expense, except where, hereinafter specified otherwise, shall restore such structures, property, or materials to a condition equal to or similar to the existing before such damage or injury was done, by repairing, rebuilding, or otherwise as may be required by the Architect. To the extent that the Contractor fails or refuses to meet the requirements of this Section and such failure and/or refusal results in the Owner incurring additional attorney's fees, professional fees, other costs or expense, the Contractor shall be liable for the same.

§ 3.13.10 If the Contractor fails to restore such property or make good such damage, the Owner may, by contract or otherwise, proceed to repair, rebuild, or otherwise restore such property as may be necessary, and the cost thereof will be deducted from any money due, or to become due, the Contractor under this Contract; or the Owner may deduct from any money due the Contractor a sum sufficient to reimburse the Owner of property so damaged.

§ 3.13.11 When the Contractor is working within a fully enclosed building with either temporary or permanent doors, the Contractor shall suitably lock the building to prevent access of unauthorized persons.

§ 3.13.12 All temporary shoring, bracing and sheet piling necessary for the underpinning and for the installation of new Work are included in the Contract Sum and shall be used in accordance with industry standards.

§ 3.13.13 Employees of the Contractor and is Subcontractors shall not park automobiles on the Owner's property except as approved by the Owner in writing or otherwise designated in the Drawings. Contractor shall direct and require all its employees and Subcontractors' employees to park where required by the Contract Documents and the municipal authority.

§ 3.13.14 The Contractor's use of and operations on the site shall not interfere with the Owner's continued operation. The Contractors shall take care to exercise and use processes that avoid any impact on the Owner's ongoing operations.

§ 3.13.15 The equipment and procedures used on portions of the Work shall be such that no damage to adjacent property or roadways will result from their use. No work of any kind shall be installed or stored in a manner which will endanger the structure of the building.

§ 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.

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§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner, Separate Contractors, or of other Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner, Separate Contractors, or by other Contractors except with written consent of the Construction Manager, Owner, and such other Contractors or Prime Contractors. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Separate Contractors, other Prime Contractors, Construction Manager, or the Owner, its consent to cutting or otherwise altering the Work.

§ 3.14.3 The Contractor, Subcontractor or Sub-Subcontractor requiring the cutting of openings in new work installed by other contractors 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. Approval to do such cutting and patching shall be received from the Construction Manager and the Architect prior to proceeding with the Work and shall include installation of such reinforcement of the Work as the Architect and the Construction Manager may direct at no additional cost to the Owner. Blocking, bracing, reinforcement, or structural enhancement required, due to cutting and patching, shall be provided at no additional cost to the Owner. Patching work shall match adjacent existing work unless otherwise noted.

§ 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. The Contractor shall clean the Work areas daily and should the occasion arise that the Construction Manager must direct the Contractor to clean an area, the Contractor shall do so within twenty-four (24) hours. In the event of a dispute between or among the Prime Contractors regarding responsibilities for cleaning up, the Construction Manager shall designate the relative responsibilities, and such designation shall be final and binding.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor. The Owner reserves the right to deduct $800.00 per day from the Contract Sum, as liquidated damages and not as a penalty, for each day that Contractor fails to comply with Construction Manager's directions for required clean-up.

§ 3.16 Access to Work

§ 3.16.1 The Contractor shall provide the Owner, Construction Manager, and Architect with access to the Work in preparation and progress wherever located.

§ 3.16.2 The General Contractor shall perform snow plowing, cleanup, and provide all temporary facilities to keep the site accessible at all times and to permit the continuous progress of work by all Contractors.

§ 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, Construction Manager, 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, Architect, or Construction Manager. 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 through the Construction Manager.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify, defend and hold harmless the Owner, Construction Manager, Architect, and their officers, directors, consultants, agents, and employees (the "Indemnified Parties" from and against all claims, damages, losses, and expenses, including but not limited to injuries to the Contractor's employees, legal fees, and defense costs arising out of or resulting from the performance of the Work, to the extent caused, in whole or in part, by the negligent, intentional or wrongful acts or omissions of the Contractor, a Subcontractor, a sub-subcontractor or material provider, 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 the Indemnified Parties or any of them. Such obligation shall not be construed to negate, abridge, or

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reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18. The Contractor agrees and does hereby assume on behalf of the Indemnified Parties the defense of any action, at law or in equity, which may be brought against the Indemnified Parties or any of them upon their demand and pay the amount of any judgment that may be entered against the Indemnified Parties in any such action. In the event that any such claim, loss, cost, expense, liability, damage or injury arises or is made, asserted or threatened against the Owner for which the Contractor or its insured does not admit coverage, or if the Owner reasonably determines such coverage to be inadequate, the Owner shall have the right to withhold from Contractor cost, expense, liability, damage or injury including, but limited to, legal fees and expenses reasonably necessary for the defense thereof. Contractor's obligations under this Section 3.18 shall survive the completion of the Work and Project.

(Paragraph deleted)

§ 3.18.2.1 In claims against any Indemnified Party 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 this Section 3.18 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 or any immunity provided under any workers' compensation acts.

§ 3.18.2.2 The Contractor and each Subcontractor, of whatever tier, hereby certifies to the Owner that it complies with all employment related laws and regulations governing employment or collective bargaining agreements, if any. Nothing in this Agreement shall be construed as divesting any Contractor of Subcontractor of its sole and exclusive right to control the means, manner, or method of performance of the Work of any Contractor of their employees. Nothing in this Agreement shall be construed in a manner that would be violative of the legal or contractual rights of any employee. The Contractor, and each Subcontractor, regardless of tier, shall defend, hold harmless, and indemnify the Owner, Construction Manager, and Architect against and from any and all claims, demands, suits, actions, costs, and expenses including reasonable attorneys' fees, growing out of any claims by an employee or independent contractor of any Contractor or Subcontractor of any tier alleging the violation of any of the individuals' employment right, whether legal, constitutional or contractual in nature. This provision shall be accorded the broadest meaning permitted by law.

§ 3.18.3 Each Contractor shall indemnify, defend, and hold harmless the Owner against any assertion of claims and/or liens, including mechanic's liens by its Subcontractors, Sub-Subcontractors, or material suppliers and against any assertion of security interests by its suppliers of goods or materials. Each Contractor and each Subcontractor and supplier of any tier acknowledges that the Project is work for a purely public purpose; therefore, Pennsylvania law does not permit mechanics' liens to be filed against the Owner, the Property, the Project, or any portion thereof.

§ 3.18.4 No provision of Section 3.18 shall give rise to any duties on the part of the Architect, the Owner or the Construction Manager not otherwise provided for by law.

§ 3.18.5 In the event that Contractor or its insurer is requested but refuses to honor the defense and indemnity obligations hereunder, then the party refusing to honor such requests shall, in addition to all other obligations, pay the cost of bringing any such action, including, but not limited to, legal fees to the Indemnified Party, including, but not limited to, any legal, expert, or professional fees and costs incurred by the Indemnified Parties in enforcing the defense and indemnity obligations hereunder. Furthermore, the Contractor shall be solely responsible for all legal fees incurred by the Owner in responding to any claims or liens filed or asserted by a Subcontractor of any tier or a supplier of any tier.

§ 3.18.6 Any part of the Work which may cause contamination or pollution to the environment shall be performed by subcontractors who are properly certified to do such work and who normally carry contractually assumed indemnification insurance and public liability insurance to cover such Work in the amount required to be carried by Contractor for liability and contractually assumed liability coverage under this Contract.

§ 3.19 Representations and Warranties

§ 3.19.1 The Contractor represents and warrants the following to the Owner (in addition to the other representations and warranties contained in the Contract Documents), as an inducement to the Owner to execute the

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Owner-Contractor Agreement, which representations and warranties shall survive the execution and delivery of the Owner-Contractor Agreement and the Final Completion of the Work:

.1 that it is financially solvent, able to pay its debts as they mature and possesses sufficient working capital to complete the Work and perform its obligations under the Contract Documents.

.2 that it is able to furnish the personnel, tools, materials, supplies, equipment and labor required to complete the Work and perform its obligations hereunder and has sufficient experience and competence to do so.

.3 that it is authorized to do business in the Commonwealth of Pennsylvania and is properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work for the Project.

.4 that its execution of the Owner-Contractor Agreement and its performance thereof is within its duly authorized powers.

.5 that it is familiar with all Federal, State, Municipal, and Department laws, codes, ordinances and regulations, which may in any way affect the Work of those employed herein, including, but not limited to, any special acts relating to the Work or to the Project of which it is a part.

.6 that it has determined what local ordinances, if any, will affect its Work. The Contractor has checked for any County, City, Borough, or Township rules or regulations applicable to the area in which the Project is being constructed and in addition, the Contractor has checked for any rules or regulations of other organizations having jurisdiction, including, but not limited to, chambers-of-commerce, planning commission, industries, or utility companies who have jurisdiction over lands which the Contractor occupies. Any costs of compliance with local controls are included in the Contract Sum, even though documents of such local controlling agencies are not listed herein.

.7 that such temporary and permanent Work required by the Contract Documents as is to be done by it, can be satisfactorily constructed and used for the purposes for which it is intended, and that such construction will not injure any person or damage any property.

.8 that it is familiar with local trade jurisdictional practices.

.9 that it has carefully examined the Plans and Specifications and that, from its own investigation, it has satisfied itself as to the nature and location of the Work, the character, quality and quantity of the surface and subsurface materials likely to be encountered, the character of equipment and other facilities needed for the performance of the Work, and the general local conditions, and all other materials which may in any way affect the Work or its performance.

.10 that it is insurable in the Commonwealth of Pennsylvania.

§ 3.20 The Contractor agrees (in addition to the representations and warranties contained in the Contract Documents), as an inducement to the Owner to execute the Contract, that the Contractor shall be restricted to the rights and remedies set forth in Article 15 of these General Conditions with respect to Claims between the Contractor and the Owner. However, the Owner's right to recover under the Contract Documents, at law or in equity shall not be restricted to the rights and remedies set forth in Article 15 of these General Conditions. This Section 3.20 shall survive the expiration or sooner termination of the Contract.

§ 3.21 Record Drawings

Contractor shall prepare and provide a set of reproducible record drawings showing significant changes in the Work made during construction based on marked-up prints, drawings and other data furnished by the Contractor to the Architect, including, but not limited to, the location of water, sewer, telephone, electric, gas and any other utility lines, and the Contractor shall certify these drawings as accurate. Said drawings shall be provided by the Contractor to the Architect.

§ 3.22 Owner's Manuals

Contractor shall turn over to Architect, for delivery to Owner, all operation manuals, maintenance instructions, and warranties for all equipment on or before the close of the Project.

ARTICLE 4 ARCHITECT AND CONSTRUCTION MANAGER

§ 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 and is referred to throughout the Contract Documents as if singular in number. The term "Architect" shall mean the Architect/Engineer or the authorized representative thereof.

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§ 4.1.2 The Construction Manager is the person or entity retained by the Owner pursuant to Section 2.3.3 and identified as such in the Agreement.

§ 4.1.3 Duties, responsibilities, and limitations of authority of the Construction Manager and Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Construction Manager and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents and will be the Owner's representatives during construction until the date the Architect issues the final Certificate for Payment and with the Owner's concurrence, from time-to-time during the warranty or correction period for correction of the Work described in Section 12.2. The Construction Manager and Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents. The Architect and Construction Manager will endeavor to guard the Owner against defects and deficiencies in the Work on the Project.

§ 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 and keep the Owner informed about the progress and quality of the portion of the Work completed, to guard the Owner against defects and deficiencies in the Work, 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. On the basis of the site visits, the Architect will keep the Owner and the Construction Manager reasonably informed about the progress and quality of the portion of the Work completed and promptly report to the Owner and Construction Manager known deviations from the Contract Documents and defects and deficiencies observed in the Work.

§ 4.2.3 The Construction Manager shall provide one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner and Architect reasonably informed of the progress of the Work, and will promptly report to the Owner and Architect known deviations from the Contract Documents and the most recent Project schedule, and defects and deficiencies observed in the Work.

§ 4.2.4 The Construction Manager will observe the activities of the Contractor and inform the Architect and Owner of any deviations from the latest approved construction schedule. and the Project Coordinators shall schedule and coordinate the activities of the Contractor and other Prime Contractors in accordance with the latest approved Project schedule.

§ 4.2.5 The Construction Manager, except to the extent required by Section 4.2.4, and 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, and neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of, or be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work.

§ 4.2.6 Communications. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall communicate with each other through the Construction Manager's and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Construction Manager 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 other Prime Contractors shall be through the Construction Manager and shall be contemporaneously provided to the Architect if those communications are about matters arising out of or related to the Contract Documents. Communications by and with the Owner's own forces and Separate Contractors shall be through the Owner.

§ 4.2.7 The Construction Manager and Architect will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

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§ 4.2.8 The Owner, Architect and Construction Manager have the authority to reject Work that does not conform to the Contract Documents and will notify each other about the rejection. Whenever the Owner or Construction Manager considers it necessary or advisable, the Owner or Construction Manager will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, upon written authorization of the Owner, whether or not the Work is fabricated, installed or completed. The foregoing authority of the Owner and Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Owner's or Construction Manager's authority to act under this Section 4.2.8 nor a decision made by any of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect, Owner or the Construction Manager to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.2.9 Intentionally deleted.

§ 4.2.10 The Construction Manager shall coordinate with the Prime Contractors the distribution of the submittals required by the Contract Documents for review by the Architect. The Construction Manager will require that the Prime Contractors coordinate all submittals so as to integrate the Work of other Prime Contractors and Separate Contractors. All Prime Contractors must review the submittals of other Prime Contractors to determine how the Work affects the Contractors planned Work and also to coordinate and schedule all required Work. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner, Architect, and Construction Manager that the Contractor has reviewed and recommended them for approval. Actions will be taken in accordance with a Project submittal schedule approved by the Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness while allowing sufficient time to permit adequate review by the Architect. The Construction Manager is not responsible for any design aspects of the Project, and therefore, the Construction Manager's submittal responsibility shall be limited to coordinating the procedure of submittal processing with the Architect and Prime Contractors.

§ 4.2.11 The Architect will review and provide one of the following actions 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 as to cause no delay in the Work or in the activities of the Owner, Contractor, other Prime Contractors, or other Separate Contractors while allowing sufficient time in the Architect's professional judgment to permit adequate review. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

§ 4.2.12 Review of the Contractor's submittals by the Construction Manager and Architect 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 Construction Manager and 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 Construction Manager and 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.

§ 4.2.13 The Construction Manager will prepare Change Orders and Construction Change Directives.

§ 4.2.14 The Construction Manager and the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7, and the Architect will have authority to order minor changes in the Work as provided in Section 7.4. The Architect, in consultation with the Construction Manager, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.15 Utilizing the documents provided by the Contractor, the Construction Manager will maintain at the site for the Owner one copy of all Contract Documents, approved Shop Drawings, Product Data, Samples, and similar required submittals, in good order and marked currently to record all changes and selections made during construction. These

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will be available to the Architect and the Contractor and will be delivered to the Owner upon completion of the Project.

§ 4.2.16 The Construction Manager will assist the Architect in conducting inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion in conjunction with the Architect pursuant to Section 9.8; and receive and forward to the Owner written warranties and related documents required by the Contract and assembled by the Contractor. The Construction Manager will forward to the Architect a final Application for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

§ 4.2.17 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 Construction Manager of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.18 All Requests for Information shall be submitted by the Contractor to the Construction Manager through the web-based project management system. The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of the Construction Manager, Owner, or Contractor through the Construction Manager. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. .However, the Architect shall not have the authority to bind the Owner to accept Work to which the Owner objects as being deficient or otherwise inconsistent with the Contract Documents. The Contractor shall be responsible for the Architect's fees and expenses in responding to Requests for Information where such information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner provided information, Contractor provided coordination drawings, or prior Project correspondence or documentation.

§ 4.2.19 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 in the absence of negligence, will not be liable for results of interpretations or decisions so rendered in good faith.

§ 4.2.20 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents, and if approved by the Owner.

§ 4.2.21 The Construction Manager will receive and review requests for information from the Contractor, and forward each request for information to the Architect, with the Construction Manager's recommendation. The Architect will review and respond in writing, through the Construction Manager, to requests for information about the Contract Documents. The Architect's response to such requests will be made within 14 days unless the Architect determines additional time is required. If the Architect determines additional time is required, the Architect will inform the Owner and Contractor, in writing, of the additional time needed. The Construction Manager's recommendation and the Architect's response to each request 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 request for information at no additional cost to the Owner.

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 other Prime Contractors or Separate Contractors or the subcontractors of other Prime Contractors or Separate Contractors.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor or other Sub-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.

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§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

(Paragraph deleted)

§ 5.2.1 The Contractor shall, as stated below, notify in writing to the Construction Manager, for review by the Owner, Construction Manager and Architect, the name, trade, and subcontract amount for each Subcontractor, 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. In all cases, this notification shall be received in writing no less than thirty (30) days prior to a Subcontractor starting Work. The Contractor shall not contract with any Subcontractor or supplier to whom the Construction Manager, Owner or Architect has made reasonable written objection. Within 10 days of receipt of the information, the Construction Manager may notify the Contractor whether the Owner, the Construction Manager or the Architect (1) has reasonable objection to any such proposed person or entity or, (2) requires additional time for review. Failure of the Construction Manager to provide notice within the 10-day period shall constitute notice of no reasonable objection.

§ 5.2.1.1 Not later than 10 business days after the date of the Notice to Proceed, the Contractor shall furnish in writing to the Owner through the Construction Manager 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 Construction Manager and Owner reserve the right to deduct $800.00 from the Contract Sum, as liquidated damages and not as a penalty, for each additional day that all information is not furnished in addition to all other remedies provided for herein.

§ 5.2.1.2 Not later than 30 days after the date of the Notice to Proceed, the Contractor shall furnish proof in writing (if requested) that all subcontracts and purchase orders for all work in the Project Specifications have been executed. The Construction Manager and Owner reserve the right to deduct $800.00 from the Contract Sum, as liquidated damages and not as a penalty, for each day that any portion of Work has not been contracted for in addition to all other remedies provided for herein.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner, Construction Manager 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, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager or Architect has no reasonable objection; however, no increase in the Contract Sum or Contract Time shall be allowed for any such substitution.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such substitution.

§ 5.2.5 Upon request, the Contractor shall furnish the Owner, Construction Manager and Architect with 1 electronic copy of any and all agreements by, between and among the Contractor and each Subcontractor along with all documentation related to such agreements. The Contractor shall name the Owner as a third-party beneficiary of each Subcontract and, whether written in such subcontract or not, each Subcontractor, having received and reviewed these General Conditions as evidenced by its execution of the subcontract, agrees that Owner shall be a third-party beneficiary of its subcontract.

§ 5.3 Subcontractual Relations

§ 5.3.1 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, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager 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

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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.

§ 5.3.2 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.

§ 5.3.3 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.

§ 5.4 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 in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

Except as set forth in Section 5.4.3 hereof, when the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract accruing on or after the date of assignment.

§ 5.4.2 The Contractor agrees, upon Owner's request, to execute whatever instruments Owner may require to confirm such assignment.

§ 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, and in such case, the successor contractor or other entity and not the Owner shall assume the Contractor's rights and obligations under the subcontract accruing on or after the date of assignment.

§ 5.5 Payments to Subcontractors or Material Supplier(s) by the Contractor

§ 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. Sec. 501, et seq., and all other applicable legal requirements. In the event a Subcontractor or material supplier alleges that the Contractor has failed to pay it in full, the Owner may, in addition to its other rights, set off said amounts from any amount due and owing to the Contractor.

§ 5.6 Payments to Subcontractors by the Owner

§ 5.6.1 If the Owner fails to approve an Application for Payment for a cause which the Owner and 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. In such case, the amount(s) paid by the Owner to such Subcontractor shall be deducted by Change Order from the Contactor's Contract Sum.

§ 5.6.2 The Owner shall have no obligation to pay, or to see to the payment of, any monies to any Subcontractor or material supplier. Nothing contained in Section 5.6.1 shall be deemed to create any contractual duty of the Owner to any Subcontractor of any tier or Supplier of any tier or to create any rights in any Subcontractor of any tier or Supplier of any tier against the Owner.

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§ 5.6.3 The Contractor shall promptly advise the Owner and the Architect of any claim or demand by a Subcontractor claiming that any amount is due to such Subcontractor claiming any default by the Contractor in any of its obligations to such Subcontractor.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction with Own Forces and to Award Other Contracts

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identically or substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation. This Project will be performed with Multiple Prime Contractors as indicated in the Contract Documents. The Contractor shall be aware that schedule adjustments will be required to coordinate with the Work of their Contract with the Work of other Prime Contractors.

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces or Separate Contractors, the Owner shall provide for coordination of such forces and Separate Contractors with the Work of the Contractor, who shall cooperate with them. When the Owner performs construction or operations with the Owner's own forces including persons or entities under separate contracts administered by the Construction Manager, the Construction Manager shall provide for coordination of such forces with the Work of the Contractor, who shall cooperate with them.

§ 6.1.3 When separate prime 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 Prime Contractor who executes each separate Owner-Contractor Agreement.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner's own forces, Separate Contractors, Construction Manager and other 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's own forces, Separate Contractors or other Contractors, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Construction Manager and Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor or other Contractors that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Construction Manager and 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 or other Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work.

§ 6.2.2.1 Neither the Owner, the Construction Manager nor the Architect nor their Consultants shall be responsible for the coordination of the Contractor's Work. Coordination of the Contractor's Work shall be governed by the Contract Documents.

§ 6.2.2.2 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, electrical, and plumbing Work shall also be subject to the responsibility of the Project Coordinator in connection with the rendering of final construction decisions. Such responsibility shall however be invoked only after the provisions of Division 01 have been fully observed.

§ 6.2.3 Costs caused by delays, improperly timed activities or defective construction shall be borne by the parties responsible therefore, excepting, however, Owner, Architect and Construction Manager who shall not be liable to any Contractor or subcontractor for claims or damages of monetary or other nature caused by or arising out of delays of other contractors, contemplated or not contemplated. The sole remedy against the Owner, Architect, and Construction Manager for delays shall be the allowance to a successful claimant of additional time for completion of Work. If, notwithstanding the above, the Owner is required to reimburse a separate Contractor because of delays, lack of performance, improperly timed activities, or defective construction of the Contractor that failed to perform, then the

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Contractor responsible for the delay, lack of performance, improperly timed activities, or defective construction that Contractor shall then reimburse the Owner for the costs incurred by the Owner which are payable to the separate contractor because of delays, improperly timed activities, or defective construction of the Contractor. If the Contractor asserts a claim against the Owner, Architect, or Construction Manager in violation of the foregoing provisions, the Contractor shall, in addition to all other relief that is afforded, reimburse the Owner, Architect, and Construction Manager for its reasonable costs and fees of attorneys, architects, engineers, or other professionals, plus interest at the rate of ten (10%) percent per annum until such costs are paid. In the event that a separate contractor makes a claim or demand upon the Owner, the Architect and the Construction Manager, or any of them (notwithstanding that such claim or demand is in violation of such separate contractor's Contract for Construction with the Owner) for or on account of any actual or alleged act, omission, fault or breach of the Contract, by the Contractor, the Contractor shall indemnify and defend any and all of them from such claim or demand.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor causes to completed or partially completed construction, or to property of the Owner, Separate Contractors, or other Prime Contractors as provided in Section 10.2.5. The Contractor agrees to defend, indemnify and hold harmless the Owner, Construction Manager and Architect and the consultants, agents and employees of any of them from and against any claims or damages brought by a Prime Contractor or other separate Contractor arising out of actions or omissions of the Contractor, or his Subcontractors, Sub-subcontractors, or suppliers in performing its Work under the Contract Documents. 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. The separate Contractor claiming damages at his expense subject to his right to recover damages shall continue Work. If such separate contractor sues the Owner, the Architect, or Construction Manager on account of any damage alleged to have been caused by another Contractor, the Owner, Architect or Construction Manager shall notify such other Contractor who shall defend such proceedings at the Contractor's expense, and if any judgment or award against the Owner, Construction Manager, or Architect arises therefrom the notified Contractor shall pay or satisfy it and shall reimburse the Owner, Construction Manager, or Architect for all attorneys' fees and court costs which the Owner, Construction Manager, or Architect has incurred.

§ 6.2.4.1 If any Prime contractor sues the Owner, Construction Manager, or Architect on account of any damage alleged to have been caused by another Contractor, the Owner, Construction Manager, or Architect, shall notify the Contractor that allegedly caused the damage. That Contractor shall defend such proceedings at the Contractor's expense, and if any judgment or award against the Owner, Construction Manager, or Architect arises therefrom the Contractor shall pay or satisfy it and shall reimburse the Owner, Construction Manager, or Architect for all attorneys' fees and court costs which the Owner, Construction Manager, or Architect has incurred.

§ 6.2.5 The Owner, Separate Contractors, Prime Contractors and other Contractors shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.2.5.1 If the Contractor, or any of its Subcontractors or Sub-Subcontractors, or their respective agents, servants, or employees, causes damage to the Work or property, or by lack of due diligence delays or interferes with the Work of another Contractor, Subcontractor, or other Prime Contractor or their subcontractors, and such party incurs additional expense or damage as a result, any claim, dispute, or other matter arising therefrom shall be resolved exclusively by binding arbitration as provided in this Section 6.2.5. Such arbitration shall be conducted in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then in effect, unless the affected parties mutually agree otherwise in writing. Claims between or among Contractors, Subcontractors, other Prime Contractors, or their respective Sureties shall not delay or suspend the progress or completion of the Work, which shall continue pending final resolution of such claims.

§ 6.2.5.2 The Owner, Architect, and Construction Manager shall not be joined as parties to any arbitration or dispute arising under this Section 6.2.5, nor shall they be liable for damages arising out of disputes between or among Contractors, Subcontractors, other Prime Contractors, or their respective Sureties. The Contractor and its Subcontractors expressly waive any claims against the Owner, Architect, and Construction Manager for damages arising from the acts, omissions, delays, or interference of other Contractors, Subcontractors, other Prime Contractors, or their subcontractors, including, without limitation, claims for delay, acceleration, inefficiency, out-of-sequence work, stacking of trades, overtime, or disputes over scope of work.

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§ 6.2.5.3 A demand for arbitration shall be made in writing and filed with the American Arbitration Association and served upon the other affected Contractors or Subcontractors within thirty (30) days after the claimant knew or should have known of the claim. Copies of the arbitration demand shall be provided to the Owner, Architect, and Construction Manager for informational purposes only. While not parties to the arbitration, the Owner, Architect, and Construction Manager may, if requested, provide testimony or documentary evidence as witnesses. The Owner shall receive copies of documents submitted to the arbitrator at no cost. The arbitration award shall be final, and judgment upon the award may be entered in any court of competent jurisdiction.

§ 6.2.5.4 The Contractor and each of its Subcontractors agree that their sole and exclusive remedy for any injury, damage, loss, or expense arising out of disputes covered by this Section 6.2.5 shall be against the responsible Contractor, Subcontractor, other Prime Contractor, or their respective Sureties, and not against the Owner, Architect, or Construction Manager. This Section 6.2.5 is intended to benefit all Prime Contractors, Subcontractors, and their Sureties on the Project and shall confer limited third-party beneficiary status solely for the purpose of enforcing the arbitration and risk-allocation provisions contained herein. The Contractor shall require all Subcontracts and Sub-Subcontracts to include provisions substantially similar to this Section 6.2.5 as a condition of participation in the Project.

§ 6.2.5.5 The Contractor and each of its Subcontractors acknowledge that the restrictions contained in these General Conditions are reasonable and necessary in order to protect the legitimate interests of the Owner and that any violation of these General Conditions would result in irreparable injuries to the Owner and monetary damages would be inadequate to compensate the Owner for a violation of these General Conditions. Therefore, the Contractor and each of its Subcontractors hereby agree that if the Contractor or Subcontractor disregard any paragraph of these General Conditions, including, without limitation, any portion of this Article 6, and institutes or attempts to institute any proceeding (e.g., arbitration, litigation, mediation, etc.) against the Owner, Architect, or Construction Manager for including, without limitation, injuries, damages or expenses resulting from disputes between or among Contractor, Sureties, Subcontractors, other Prime Contractors or their Subcontractors, the Owner is entitled to obtain from any court of competent jurisdiction preliminary and permanent injunctive relief to prevent the Contractor or Subcontractor from pursuing any proceeding against the Owner, Architect, or Construction Manager, and the Owner is entitled to stay any such proceeding. In the event that the Owner pursues preliminary or permanent injunctive relief to prevent the Contractor from pursuing any proceeding against the Owner, Architect, or Construction Manager, or that the Owner attempts to stay any such proceeding, the Contractor and the Contractor's Surety shall be jointly and severally liable for reimbursing the Owner, immediately upon demand, for all of Owner's costs and expenses associated therewith, including, without limitation, all legal fees, professional fees, and all other costs associated therewith incurred by the Owner. In the event that the Owner pursues preliminary or permanent injunctive relief to prevent a Subcontractor from pursuing any proceeding against the Owner, Architect, or Construction Manager or that the Owner attempts to stay any such proceeding, the Subcontractor and the Subcontractor's Surety (if any) shall be jointly and severally liable for reimbursing the Owner, immediately upon demand, for all of Owner's costs and expenses associated therewith, including, without limitation, all legal fees, professional fees, and all other costs associated therewith incurred by the Owner. The Owner's rights set forth in this Section 6.2.5.5 shall be in addition to all other rights of the Owner granted in the Contract Documents, at law, or in equity.

§ 6.2.6 Dispute Routing. Claims, disputes, or matters exclusively between or among Prime Contractors, Subcontractors, or Sub-Subcontractors arising out of coordination, sequencing, delay, interference, or damage to the Work shall be resolved solely in accordance with Article 6 and shall not be asserted against the Owner, Architect, or Construction Manager.

Claims by a Contractor against the Owner shall be asserted only in accordance with Article 15. Resolution of a dispute under Article 6 shall not create, expand, or imply any duty, obligation, or liability of the Owner, Architect, or Construction Manager.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, other Multiple Prime 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 Construction Manager, with notice to the Architect, will allocate the cost among those responsible.

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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, Construction Manager, Architect and Contractor. A Construction Change Directive requires agreement by the Owner, Construction Manager 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, after receipt of a letter to proceed issued by the Construction Manager or execution of the Change Order, Construction Change Directive, or order for a minor change in the Work, whichever occurs first.

§ 7.1.3.1 Notwithstanding anything contained in the Contract Documents to the contrary, a change in the Contract Sum, the Contract Time and/or any Milestone Date shall be accomplished only by Change Order or by a Construction Change Directive. No course of conduct or dealing between the parties, no express or implied acceptance of alterations or additions of the Work, and no claim that the Owner has been unjustly enriched by any alteration or addition to the Work shall be the basis of any claim or adjustment in compensation due under the Contract and/or time period provided for under the Contract.

§ 7.1.3.2 Agreement on any Change Order shall constitute a final settlement of all direct and indirect costs associated with such change and any and all adjustments to the Contract Sum and the Contract Time. In the event a Change Order increases the Contract Sum, the Contractor shall include the Work covered by such Change Order in Applications for Payment as if such Work were originally part of the Contract Documents. Present or future claims by the Owner relating to defective performance of the Work shall not be deemed settled through agreement on a Change Order unless so expressly agreed in writing.

§ 7.1.4 Matters involving extra Work and changes in the Work are subject to the following provisions:

§ 7.1.4.1 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.

§ 7.1.4.2 Contractor agrees that prices for changes in the Work and or 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.

§ 7.1.4.3 A Change Order or Construction Change Directive will establish whether the Contractor is permitted extra time because of extra Work or changes in the Work and, if so, the amount of extra time permitted. Such determinations will be final and will not alter the fact that time is of the essence in the Contract.

§ 7.1.4.4 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.

§ 7.1.4.5 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 subcontracts. Labor and materials shall be itemized in the manner prescribed herein. When major cost items are subcontracted, these costs shall be itemized also.

§ 7.1.4.6 All Change Orders shall be accompanied by detailed price breakdowns.

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§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Construction Manager and signed by the Owner, Construction Manager, Architect, and Contractor, 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.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

§ 7.2.3 In the event that the Contractor makes change order requests that are not required due to unforeseen or changed conditions, errors or omissions in the Contract Documents, commercial unavailability of specified products/materials, or to achieve overall project cost savings for the Owner, the Owner shall have the authority in its sole discretion, to disregard any subsequent Change Order requests made by such Contractor on the same or similar scope of services and the Contractor's sole remedy against the Owner under this Agreement shall be pursuant to Article 15 of these General Conditions. Furthermore, to the extent the Owner incurs any legal fees, professional fees, expenses, or costs (including, but not limited to, employee costs), arising out of or resulting from the Contractor making an excessive number of Change Order requests, the Contractor shall be liable to the Owner for such legal fees, professional fees, expenses, and costs.

§ 7.2.4 Any action(s) by the Owner, Construction Manager, Architect and/or the Contractor other than actions taken pursuant to the procedures set forth in Section 7.2.1 shall not constitute the approval of a Change Order, including, without limitation, the Owner's, Construction Manager's and/or the Architect's execution of the Contractor's time sheets upon which the Contractor submits a Change Order request. Furthermore, to the extent the Owner incurs any legal fees, professional fees, expenses, or costs (including, but not limited to, employee costs), arising out of or resulting from the Contractor's failure to follow the proper procedures for approval of a Change Order, the Contractor shall be liable for such legal fees, professional fees, expenses and costs.

§ 7.2.5 At Owner's election, Change Order costs shall be calculated by the Contractor and each Subcontractor or Sub-sub-contractor as follows:

§ 7.2.5.1 Actual costs of labor, including social security and old age and unemployment insurance, fringe benefits and workers' compensation insurance associated with the Change in the Work (as calculated per Section 7.3.4).

§ 7.2.5.2 Actual costs of materials, supplies and equipment, including cost of transportation used in performing the Change in the Work.

§ 7.2.5.3 Actual rental costs of machinery and equipment rented from third parties, exclusive of hand tools required by the Change in the Work, whether incorporated or consumed.

§ 7.2.5.4 Actual costs of premiums for all bonds and insurance and permit fees and sales, use or similar taxes related to the Change in the Work.

§ 7.2.5.5 For any adjustments to the Contract Sum (other than those based upon unit prices which include overhead and profit), the Prime Contractor agrees to charge and accept, as payment for overhead and profit, the following percentages of costs attributable to the addition, deletion or change to the Work.

.1 For adjustments which total less than fifty thousand dollars ($50,000) exclusive of overhead and profit, a total of 10% for overhead and profit.

.2 For adjustments which total more fifty thousand dollars ($50,000) but less than two hundred fifty thousand dollars ($250,000), exclusive of overhead and profit a total of 8% for overhead and profit.

.3 For adjustments which total more than two hundred fifty thousand dollars ($250,000) exclusive of overhead and profit, a total of five percent (5%) for overhead and profit.

.4 When both additions and credits are involved in any one change, the allowance for overhead and profit shall be figured on the basis of the net increase, if any

.5 To the Contractor for work performed by other than its own forces (i.e. their subcontractors), the allowance for overhead and profit shall not exceed 5%.

.6 The charges for overhead and profit referred to herein shall include all indirect costs customarily recoverable as overhead, including home office overhead and field office overhead.

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§ 7.2.6 Unit Prices and their use in Contract Adjustments

§ 7.2.6.1 If Unit Prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such Unit Prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable Unit Prices shall be equitably adjusted.

§ 7.2.6.2 Approved Unit Prices, when accepted by the Construction Manager and Owner, shall be used where they apply to determine an equitable adjustment of the Contract Sum in connection with extra Work or changes ordered under the Contract. Approved Unit Prices shall apply to both additions to and deductions from the Contract Sum.

§ 7.2.6.3 Unit Prices submitted by a Contractor on the Bid Form for this Project shall include all profit, overhead, bonds, insurance, taxes, labor, materials, plant equipment and tools necessary and required to fully complete the Work item, as specified in detail for the Work item in the Contract Documents.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Construction Manager and signed by the Owner, Construction Manager 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 allocated based on the approved Schedule of Values 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 Construction Manager 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 Section 7.2.5.5, and which includes, without limitation, Contractor's obligations under these General Conditions and Division 01 of the Specifications. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Construction Manager 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 such as social security, old age and unemployment insurance, fringe benefits required by agreement or custom, workers' compensation insurance, (labor costs shall be the certified Base Prevailing Wage rate plus actual fringe benefits per the Prevailing Wage Determination Schedule included in the Project Manual plus FICA, SUTA, FUTA and Workmen's Compensation, and other employee costs approved by the Construction Manager and Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Additional costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and all bonds and insurance, permit fees, and sales use, or similar taxes directly related to the change shall be submitted without markup;

.5 Costs of supervision and field office personnel directly attributable to the change.

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§ 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 Owner, Architect, and Construction Manager 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. Notwithstanding anything else to the contrary in the Contract Documents, when a Construction Change Directive is not agreed upon by the Contractor, the Contractor shall continue to perform the change in the Work involved so as not to delay the Project and the Contractor's sole remedy against the Owner under this Agreement shall be pursuant to Article 15 of these General Conditions.

§ 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 plus overhead and profit as confirmed by the Construction Manager and 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, amounts not in dispute for such changes in the Work shall be included in Applications for Payment to the extent that such Work was completed under the Construction Change Directive. For any portion of such cost that remains in dispute, the Construction Manager and Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Construction Manager and Architect determine to be reasonably justified. The 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 Construction Manager and 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 Construction Manager shall prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive. The Contractor's agreement to a Change Order, or acceptance of payment therefore, or the Contractor's agreement to a Construction Change Directive, shall constitute a final settlement of all of the Contractor's rights, claims, and remedies relating to the change in the Work which is the subject matter thereof, including, without limitation, all direct and indirect costs, and all adjustments to the Contract Sum and the Contract Time or Project Construction Schedule. If the Owner and the Contractor do not agree with the Construction Manager's determination, then the parties shall resolve the dispute pursuant to the terms and conditions of Article 15.

§ 7.4 Minor Changes in the Work

§ 7.4.1 The Architect has the authority to 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 issued in writing through the Construction Manager and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly. 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 Construction Manager 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 Construction Manager 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.

§ 7.4.2 The Architect from time to time, as deemed necessary or if requested by the Owner and Construction Manager, will furnish supplementary instructions to clarify or amplify the Drawings and Specifications (Contract Documents). The supplementary instructions may be by means of drawings, or otherwise as is most appropriate, which will be consistent with the Contract Documents and true developments thereof, or amplifications reasonably inferable therefrom. The supplementary instructions shall be considered minor clarifications in the Work and shall not be an authorization for the Contractor to incur additional cost.

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§ 7.4.3 The Owner reserves the right to change the location of any piece of apparatus or equipment within five (5) feet of location shown, up to the time of rough-in, without additional expense to the Owner. The changes of the location shall be considered minor changes in the Work and shall not be an authorization for the Contractor to incur additional cost.

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 Notice to Proceed issued by the Owner or Construction Manager. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible.

§ 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.

§ 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, including the phasing schedule, and all activities, events, and milestones is a reasonable period for performing the Work. By bidding and by executing the Agreement, the Contractor confirms that the contract duration is a reasonable period for performing the work. Any preliminary construction schedule, if provided, is for information purposes only and constitutes a proposed sequence of events based on standard practices. Contractor shall independently analyze all required activities and durations necessary to perform their own work and shall not rely on dates or duration suggested by the preliminary construction schedule. The Contractor is responsible to provide the Construction Manager a detailed Construction Schedule of their work within ten (10) business days after the date of execution of the Contract and a Construction Progress Schedule that will be updated periodically to reflect progress. The dates listed in the construction schedule are of the essence and the Contractor agrees to schedule, coordinate, and staff in accordance therewith based on the actual progress of the Work as necessary to maintain the orderly progress of the Work in accordance with the construction schedule.

§ 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 by Article 11 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. The Contractor agrees to increase manpower, increase work hours, and to increase equipment, necessary to maintain projected progress schedule. Such measures undertaken by the Contractor will be at no additional cost to the Owner.

§ 8.2.4 The Notice to Proceed shall be given to the Contractors on all branches of Work concurrently and all Contractors shall be prepared to undertake their Work at such times as the progress of the Work permits them to do so.

§ 8.2.5 The Work shall reach Substantial Completion no later than the date(s) stated in the Contract Documents, and for each milestone and phase where applicable, subject to conditions stated therein, from the date of commencement of Work including authorized extensions of time approved in writing by the Owner. All Contractors shall cooperate with each other and shall coordinate their activities and Work so that the entire program of construction can be substantially complete on or before the completion dates for each milestone and phase.

§ 8.2.6 The Contractor shall complete the whole of the Work, and all milestones and phases as applicable, at or before the time or times stated. Contractor shall submit shop drawings and samples of material to be used, as required, and make delivery of material in accordance with the Project schedule. Contractor shall furnish, at all times, sufficient skilled workers, materials, and equipment to perform the Work to the entire satisfaction of the Construction Manager, Architect, and Owner and so as not to delay the completion of the whole or any part of the Project.

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§ 8.2.7 It is mutually agreed by and between the parties hereto that time is of the essence as to each part of the Contract and that in case of the failure on the part of the Contractor to complete any part of the Contract within the time specified and agreed upon, the Owner will be damaged thereby. If due to a Contractor's action or inaction, the Project fails to achieve any contractual milestone, including, but not limited to, Substantial Completion or Final Completion by the deadlines set forth in the Contract Documents, then the Contractor shall be responsible to the Owner for all damages, losses, and claims incurred by the Owner as a result of such delay, including, but not necessarily limited to: loss of grant or other funding, claims for delay damages from other prime contractors (to the extent asserted against the Owner in violation of Section 6.2), loss of revenue, costs of acceleration or resequencing of work, the cost extension of professional and other services on the Project, and attorney, expert, and consultant fees.

§ 8.2.8 Adherence to Schedule

§ 8.2.8.1 The Owner reserves the right to withhold monthly progress payments if the Contractor is behind schedule, unless the Contractor proves, in writing, that the delays are not the fault of the Contractor and to which the Construction Manager agrees.

§ 8.2.8.2 The monthly progress payments will only be released after the Contractor reaches the status of completion for that month comprehended by the Project construction schedule.

§ 8.2.8.3 In the event the Construction Manager determines that the performance of the Work has not progressed or reached the level of completion required by the Contract Documents and the Project construction schedule, the Owner or Construction Manager shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, but not limited to, working additional shifts or overtime; supplying additional manpower, equipment, and facilities; and other similar measures (referred to collectively as "Extraordinary Measures"). Such Extraordinary Measures shall continue until the progress of the Work complies with the stage of completion required by the Contract Documents. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the Project construction schedule and failure to comply shall be considered as breach of the Contract Documents. The Contractor shall not, under any circumstances, be entitled to an adjustment in the Contract Sum in connection with Extraordinary Measures required by Owner under or pursuant to Section 8.2.8.

§ 8.2.8.4 The Owner may exercise its rights pursuant to Section 8.2.8.3 as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with any completion dates set forth in the Contract Documents.

§ 8.2.9 PROCUREMENT SCHEDULE

If requested by the Construction Manager, the Contractor shall provide a procurement schedule within a reasonable period of time which shows items to be purchased, date of purchase, quoted dates of delivery, current estimated date of delivery, and last date of contact with the vendor. The procurement schedule shall be updated as requested by the Construction Manager.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed in the commencement or progress of the Work by any of the following clauses, the Contract Time shall be extended by Change Order for such reasonable period as determined by the Architect, based on the recommendation of the Construction Manager: (1) an act or omissions of the Owner, Owner's forces, Construction Manager, Architect, or any other Prime Contractors; (2) by changes ordered in the Work, (3) by, casualties, fire, flood, epidemic, pandemic, disease, declared state of emergency by local, state or federal government; (4) by delay authorized by the Owner pending mediation, arbitration, or by litigation, (5) or by other proven causes that the Architect determines may justify delay, No extension of Contract Time shall be granted for delays caused by rain, wind, flood, or any other natural phenomena of severity normally experienced at the Project location.

§ 8.3.1.1 After award of the Contract, no claims for additional compensation associated with completing the Work within the Contract Time shall be considered. The Contract Sum includes all costs associated with meeting the required schedule, including, without limitation, shift work, overtime, premium time, sequencing constraints, and coordination with other Prime Contractors. Failure of the Contractor to anticipate or include such costs shall not relieve the Contractor of its obligation to comply with the schedule nor entitle it to additional compensation.

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§ 8.3.1.2 No extension of Contract Time shall be granted for delays caused by the Contractor's failure to properly plan, staff, supervise, coordinate, procure materials, prepare shop drawings, or otherwise perform the Work using reasonable diligence. Delays resulting from such causes are solely the Contractor's responsibility.

§ 8.3.2 Except as expressly provided in Section 8.3.4, an extension of Contract Time shall be the Contractor's sole and exclusive remedy for all delays, disruptions, interferences, or hindrances to the Work, and shall not entitle the Contractor to recover damages or additional compensation from the Owner, Architect, or Construction Manager.

§ 8.3.3 All claims for extensions of Contract Time shall be made strictly in accordance with Article 15.

§ 8.3.4 Notwithstanding anything to the contrary in the Contract Documents, the Contractor agrees that unless there is active interference by the Owner, an extension of Contract Time shall be the sole remedy for any: delay in commencement, prosecution, or completion of the Work; hindrance or obstruction of performance; loss of productivity; acceleration, sequencing changes, or out-of-sequence work; or other similar impacts.

Active interference shall be construed to mean the Owner affirmatively acting or failing/refusing to act in a manner that prohibits the Contractor from achieving a contractual milestone, despite receipt of written notice from the Contractor of the affect of such action or failure/refusal to act. Delays caused by other Prime Contractors shall not be construed as active interference by the Owner as the Contractor has rights to claim directly against other Prime Contractors under Article 6. Differing site or unforeseen conditions and other events beyond the control of the Owner shall not constitute active interference.

In the event of active interference by the Owner, the Contractor will be entitled to recover damages if and to the extent that (1) the Contractor gives written notice to the Owner of the specific act or acts of active interference, (2) the Contractor provides detailed schedule information and supporting data demonstrating the direct and immediate impact of the active interference on the Contractor's critical path, (3) the Contractor demonstrates the damages are reasonably and necessarily incurred as an immediate result of such active interference, and (4) the Contractor demonstrates that it has made its best efforts to mitigate damages and to work with the Owner, the other Prime Contractors, the Construction Manager, and the Architect to alleviate the impact of the active interference on the schedule and the damages incurred.

Under no circumstances shall the contractor be entitled to recover against the Owner consequential damages, lost profits, impact damages, winter protection costs, or opportunity costs.

§ 8.3.5 The Contractor acknowledges that construction schedules will be updated as the Project progresses. No claim for additional compensation shall be permitted for acceleration, delay, or out-of-sequence work resulting from decisions made pursuant to this Section 8.3 or from reasonable schedule updates.

§ 8.3.6 No extension of Contract Time shall constitute a waiver of any rights of the Owner or relieve the Contractor of its obligation to complete the Work in accordance with the Contract Documents.

§ 8.3.7 If the Owner is prevented or enjoined from proceeding with the Project due to litigation or other causes beyond the Owner's control, the Contractor shall not be entitled to damages, acceleration costs, or out-of-sequence work costs. The Contract Time shall be extended by a reasonable period reflecting time lost, as determined by the Owner and Architect in writing.

§ 8.3.8 Delays attributable to lack of coordination or cooperation among the Contractor, its Subcontractors, Sub-Subcontractors, or other Prime Contractors shall not justify an increase in the Contract Sum or Contract Time and shall be resolved in accordance with Section 6.2.

§ 8.3.9 Delay Remedies Clarified.
Except as expressly stated in this Article, an extension of Contract Time shall be the Contractor's sole and exclusive remedy for delays, disruptions, interferences, or hindrances to the Work. Nothing in this Contract shall be construed as waiving claims expressly preserved under Section 8.3.4 or rights that are not legally waivable under applicable law.

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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

Within 10 days of receipt of the Notice to Proceed, the Contractor shall submit a schedule of values to the Construction Manager and 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 Construction Manager and the Architect. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment..

§ 9.2.1 Projects with multiple sites or multiple phased projects, provided separate schedule of values for each building, phase or site.

§ 9.2.2 The schedule of values shall include the following line items with values calculated as follows:

Final Paperwork: 1% of Contract value.

§ 9.2.3 The Schedule of Values shall be broken down with separate line items for labor and materials corresponding to the Specification Sections.

§ 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 Construction Manager an itemized Application for Payment prepared in accordance with the schedule of values and Contract Documents, 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, Construction Manager or Architect require, such as copies of requisitions, and releases of waivers of lien from Subcontractors and suppliers and shall reflect retainage if provided for in the Contract Documents. The form of Application for Payment shall be a template provided by the Construction Manager. Construction Manager will issue an Invitation to Bill monthly through the web-based Project Management system. By signing each Application for Payment, the Contractor stipulates and certifies to the following: that the information presented is true, correct, accurate and complete; that the Contractor has made the necessary detailed examinations, audits and arithmetic verifications; that the submitted Work has been completed to the extent represented in the Applications for Payment; that the materials and supplies identified in the Applications for Payment have been purchased, paid for and received; that the Subcontractors have been paid as identified in the Applications for Payment or that Contractor has been invoiced for same; that he has made the necessary on-site inspections to confirm the accuracy of the Applications for Payment; that there are no known mechanics' or materialmens' liens outstanding at the date of this requisition; all due and payable bills with respect to the Work have been paid to date or are included in the amount requested in the current application; that except for such bills not paid but so included, there is no known basis for the filing of any mechanics' or materialmens' liens on the Work; that the Payment Application includes only Work self-performed by Contractor or for which Contractor has been invoiced; and that releases from all Subcontractors and materialmen have been obtained in such form as to constitute an effective release of lien under the laws of the Commonwealth of Pennsylvania covering all Work performed and for which payment has been made by the Owner to the Contractor.

§ 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 Construction Manager and Architect, but not yet included in Change Orders. Owner may withhold payment on disputed Construction Change Directive amounts.

§ 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.

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§ 9.3.1.3 Work applicable to the Contract Sum shall be kept separate from Work applicable to Change Orders. The Work of each shall contain a summary and a breakdown as stipulated by the Contract Documents.

§ 9.3.1.4 Contractor expressly waives any right to penalties, interest, and attorney's fees pursuant to the prompt payment provisions of the Pennsylvania Commonwealth Procurement Code, 62 Pa. C.S. § 3931 et seq.

§ 9.3.2 Stored Materials

§ 9.3.2.1 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.

§ 9.3.2.2 Materials stored off the construction site shall not be included for payment in the Contractor's application for payment unless prior written approval of the Owner has been obtained. Payment for materials stored off the construction site shall be subject to the conditions in this Section 9.3.2 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 provide waivers of liens, encumbrances or claims relating to the bailment of the materials stored off site or as otherwise required by Owner.

.4 Contractor shall provide Owner all information necessary for the filing of any notices under the Uniform Commercial Code relating to the materials stored off the construction site as may be required by Owner.

.5 The materials stored off the construction site shall be clearly and conspicuously labeled so as to identify Owner's title to the materials and shall be segregated and not commingled with other materials at the storage location.

.6 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.

.7 Contractor shall be responsible for and shall pay all costs of transportation of the materials to the construction site.

.8 Neither Owner's payment for materials stored off the construction site nor the transfer of title to Owner shall in any way reduce Contractor's liability for the complete installation and construction relating to said materials or liability under any performance bond provided for the Project.

.9 Contractor agrees to make the materials available for inspection by the Owner or Owner's representative at any time upon Owner's request.

§ 9.3.2.3 Materials stored on or off site shall be covered at all times from the weather. Any material or equipment, including outdoor exposed equipment, shall be suitably covered and protected at all times until final installation.

§ 9.3.2.4 The Contractor in making or ordering material shipments shall not consign or have consigned materials, equipment or any other items in the name of the Owner. The Owner shall not be under any obligation to make payment for charges on shipments made by or to the Contractor but may, at its option, pay such charges in which case the Contractor shall reimburse the Owner for the amount of such payments plus a service charge of twenty-five percent (25%) of the amount so paid.

§ 9.3.2.5 Materials delivered and stored both on and offsite are the responsibility of the Contractor. The Contractor shall be solely responsible for their safekeeping and usability at the time they are to be incorporated in the Work, and shall, at their own expense, care for and protect the same, employ security as needed, and take out insurance against theft, loss from other cause, damage, destruction and/or such other risks as may be involved which would render the aforesaid materials unfit or unsuitable for use in the Project. Any lost, stolen, or damaged materials shall be replaced at Contractor's expense. Materials shall not be delivered earlier than reasonably necessary for proper progress of the Work unless prior approval is granted by the Owner.

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§ 9.3.2.6 All material and work incorporated in the Work covered by partial payments made shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of materials and Work upon which payments have been made or the restoration of any damaged Work, or as a waiver of the right of the Owner to require the fulfillment of all the terms of the Contract.

§ 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. Contractor shall indemnify, defend, and hold Owner harmless from any liens, claims, security interests or encumbrances filed by the Contractor, Subcontractors, or anyone claiming by, through or under the Contractor or Subcontractor for items covered or partially covered by payments made by the Owner to Contractor.

§ 9.3.4 Retainage

§ 9.3.4.1 In accordance with 62 Pa. C.S.A §3921, 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 the Construction Manager 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. A specific cause for greater withholding shall include, without limitation, the following:

.1 The Contractor's inability to produce evidence satisfactory to the Construction Manager and/or the Owner evidencing payments for materials, labor and/or payments to Subcontractors, manufacturers or suppliers.

.2 The existence of a dispute between the Owner and the Contractor regarding increased costs claimed by such Contractor.

.3 Contractor's failure to complete the Work in accordance with the Contract Documents, including without limitation, the Drawings and Specifications.

.4 Defective Work or damaged Work identified subsequent to installation.

.5 Failure to comply with any of the Project requirements including, but not limited to, schedule, coordination, staffing, supervision, subcontractors, submittals, etc.

§ 9.3.4.2 In addition to the Owner's right to determine if a specific cause for greater withholding exists, the Architect and Construction Manager shall be entitled to determine if a specific cause for greater withholding exists under this Section. The Architect and Construction Manager may, with Owner's approval, reject the reduction in retainage if the Contractor is not making satisfactory progress in its Work or if the Architect and Construction Manager determine that there is a specific cause for greater withholding. The Architect and Construction Manager will consider the following items when reviewing a request for reduction in retainage and failure to meet any of the following requirements may be considered by the Architect and Construction Manager as sufficient grounds for rejecting a reduction of retainage.

.1 Satisfactory performance of the Work.

.2 Satisfactory maintenance of the Project schedule.

.3 Proper manning of the Project.

.4 Satisfactory completion of the Work.

.5 Satisfactory organization of the Project.

.6 Proper organization and coordination of Subcontractors.

.7 Proper coordination with other Prime Contractors, Owner's forces, and Separate Contractors.

.8 All defective Work has been remedied or is in the process of being remedied.

.9 Work completed is not in contention.

.10 Satisfactory follow-through of paperwork, certified payrolls, Change Order proposals, or Construction Change Directives.

.11 Satisfactory compliance with all government code statutes, regulations and laws including but not limited to local government ordinances and the rules and regulations promulgated for the PA Department of Environmental Protection and the County Conservation District.

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.12 The Architect's and Construction Manager's decision to reject a reduction of retainage shall be final and binding on the Prime Contractors.

§ 9.3.4.3 The Owner shall retain five percent (5%) of all amounts due the Contractor after the Work is fifty percent (50%) completed. In the event a dispute arises between the Owner and a Prime Contractor or separate contractor, which dispute is based upon increased costs claimed by the Prime Contractor or separate contractor occasioned by delays, or other actions of the 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 furnishes a bond satisfactory to the Owner to indemnify the Owner against the full claim.

§ 9.3.4.4 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, Construction Manager and Architect, or if the Surety withholds its consent, or for other good and sufficient reasons.

§ 9.3.4.5 All monies retained by the Owner may be withheld from the Contractor until substantial completion of the Project. Upon substantial completion, the Owner shall retain 1.5 times the sum of the estimated cost to complete all incomplete work and the estimated cost to correct or replace any defective or nonconforming work.

§ 9.4 Certificates for Payment

§ 9.4.1 Intentionally deleted.

§ 9.4.2 The Construction Manager will, within seven days after the Construction Manager receives the Contractors' Applications for Payment: (1) review the Applications and certify the amount the Construction Manager determines is due to each of Prime Contractor; (2) prepare a Summary of Contractors' Applications for Payment by combining information from each Prime Contractor's application with information from similar applications for progress payments from the other Prime Contractors; (3) prepare a Project Application and Certificate for Payment; (4) certify the amount the Construction Manager determines is due to each Prime Contractor; and (5) forward the Summary of Contractors' Applications for Payment and Project Application and Certificate for Payment to the Architect.

§ 9.4.2.1 Within seven days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a Project Certificate for Payment for such amount as the Architect determines is properly due, and notify the Construction Manager and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1 The Construction Manager will promptly forward the Architect's notice of withholding certification to the Contractors no later than the date established for such progress payment.

§ 9.4.3 The Construction Manager's certification a Project Application and Certificate for Payment, shall be based upon the Construction Manager's evaluation of the Work and the data in the Application or Applications for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager'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, or Contractors are, entitled to payment in the amount certified.

§ 9.4.4 The Architect's issuance of a Certificate for Payment or, in the case of more than one Contractor, Project Application and Certificate for Payment, shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and data in the Application for Payment or Project Application for Payment. The Architect's certification will constitute a representation 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, or Contractors are, entitled to payment in the amount certified.

§ 9.4.5 The representations made pursuant to Sections 9.4.3 and 9.4.4 are subject to continuing observations and ongoing evaluations 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 Construction Manager or Architect.

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§ 9.4.6 The issuance of a Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or 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 Construction Manager or Architect may withhold a Certificate for Payment or Project Certificate for payment, shall not certify payment, and will withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's option, the representations to the Owner required by Section 9.4.3 and 9.4.4 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.2. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment or a Project Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or 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 or Project Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the 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;
.5 damage to the Owner or a Separate Contractor or
.6 failure to carry out the Work in accordance with the Contract Documents.
.7 reasonable evidence that the Work will not be completed within applicable Project milestones otherwise within the Contract Time, and that the unpaid balance would not be adequate to cover actual for the anticipated delay; or
.8 failure to comply with government statutes, regulations and laws;
.9 failure to submit Prevailing Wage Certifications as required.

§ 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.

§ 9.5.2.1 If the Contractor disputes any determination by the Construction Manager or the Architect with regard to any Certificate of Payment, the Contractor nevertheless expeditiously shall continue to prosecute the Work.

§ 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 or Construction Manager withholds certification for payment under Section 9.5.1, 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 Construction Manager, and both will reflect such payment on the next Certificate for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment or Project 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 Construction Manager and Architect. Such payment by the Owner shall not constitute approval or acceptance of any item of cost in the Application for Payment. No partial payment made hereunder shall be or be deemed to be final acceptance or approval of that portion of the Work to which such partial payment relates or relieve the Contractor of any of its obligations hereunder with respect thereto.

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§ 9.6.2 The Contractor shall pay each Subcontractor and supplier, no later than 20 days after receipt of payment from the Owner, the amount to which the Subcontractor or supplier 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.. Each Contractor and each Subcontractor shall comply with the Pennsylvania Prompt Payment Act, 73 P.S. § 501 et seq., as applicable to public school construction projects. Nothing herein shall be deemed to waive or limit any rights or remedies available under applicable Pennsylvania law.

§ 9.6.2.1 The Contractor shall, at the request of the Owner, the Construction Manager, or the Architect, prior to the submission of an Application for Payment, submit an affidavit signed by the Contractor, Subcontractors', manufacturers and/or suppliers that they have been paid for their portion of the Work from previous Applications for Payment such Subcontractors, manufacturers and/or suppliers have performed Work.

§ 9.6.3 The Construction Manager may, on request, furnish to a Subcontractor or supplier, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Owner, Construction Manager and Architect on account of portions of the Work done by such Subcontractor or supplier.

§ 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, Construction Manager nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier.

§ 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. Issuance of a Certificate for Payment by the Architect, payment on the Contract Sum or in reducing any retaining amount, or any use or occupancy of the Work shall not relieve the Contractor of its the obligations under the Contract Documents, including warranty of the Work. At any time, the surety shall have the right to examine the status of the Work, as well as any payments.

§ 9.6.7 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 The Contractor shall defend and indemnify the Owner, Architect, and Construction Manager 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.

§ 9.7 Failure of Payment

If through no fault of the Contractor the Owner does not pay the Contractor the amount certified by the Construction Manager and Architect within 21 days after the date established in the Contract Documents then the Contractor may, upon 14 additional days' notice to the Owner, Construction Manager and Architect, stop the Work until payment of the undisputed amount owing has been received. The Contract Time shall be extended for the amount of time the Contractor stopped Work. Contractor shall not stop work or terminate this Agreement if the Architect or Construction Manager should refuse to issue a Certificate of Payment because the Application for Payment does not conform with the requirements of the Contract Documents.

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§ 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, and the local authorities having jurisdiction have issues a temporary or final Certificate of Occupancy, so the Owner can occupy or utilize the Work for its intended use. In general, the only remaining Work shall be minor in nature, so that the Owner can occupy the building or major area thereof on that date and the completion of the Work by the Contractor would not materially interfere with or hamper the Owner's normal operations. Contractor recognizes that 'normal operations' require the use and occupancy of the Work by the public, students, and Owner's staff without interruption and that any punchlist or corrective work shall be done at times when the Work is not so occupied unless otherwise permitted by Owner.

§ 9.8.1.1 The Date of Substantial Completion will be established after Substantial Completion inspection and the Architect's and Construction Manager's inspection and concurrence that the Work has achieved Substantial Completion.

§ 9.8.1.2 For Substantial Completion to occur for the Contractor, the following conditions shall be met:

.1 All of the Project parts and systems are accessible, operable and usable by the Owner, including the site work, HVAC systems, plumbing, electric, and Life Safety Systems, and commissioning of such systems has been successfully completed.

.2 The Project is clean, as defined elsewhere in the Contract Documents.

.3 Operation and maintenance manuals have been submitted to the Architect through the Construction Manager.

.4 Training of the Owner's personnel has taken place as required elsewhere in the Specifications.

.5 Annotated Record Drawings have been submitted to the Architect through the Construction Manager.

.6 All Federal, State and local authorities having jurisdiction over the Project have issued the requisite occupancy permits and/or approvals so that the Owner can occupy or utilize the Work for its intended purpose.

§ 9.8.1.3 There will be a phased completion date for each phase to account for and address retainage reduction for select phases of the Project agreed to by the Contractor with the Construction Manager and Architect in accordance with the specific milestone completion dates where Owner takes beneficial use of certain designated phases. The conditions of phased completion shall be similar to those stated for Substantial Completion of the entire Project except that the warranty will not begin. Warranties will begin only at Substantial Completion of the entire Project.

§ 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 notify the Construction Manager and the Contractor, Architect, and Construction Manager shall jointly prepare a comprehensive list of items (punchlist) to be completed or corrected to achieve Final Completion. The punchlist shall be assembled in the web-based project management software. 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 completion of the list, the Architect, assisted by the Construction Manager, 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 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, assisted by the Construction Manager, to determine Substantial Completion. If more than one inspection for Substantial Completion is required, the Contractor will be billed and responsible for the professional fees and services of the Architect and/or Construction Manager for performing all subsequent inspections.

§ 9.8.4 When the Architect, assisted by the Construction Manager, determines that the Work of all of the Contractors, or designated portion thereof, is substantially complete, the Construction Manager will prepare, and the Construction Manager and Architect shall execute, 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

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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 upon certification by Architect that retainage is due to Contractor. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.8.5.1 Inspections for Substantial Completion will be conducted only at the completion of the Project or a scheduled phase of the Project. Such inspection will take place only when all Prime Contractors are complete with the Project or that scheduled phase of the Project. Any items to be completed or corrected that remain on the punchlist shall have a value of 150% of the cost affixed to them. Construction Manager, after consultation with the Architect, will provide the valuation. Such amount shall be retained from payments and held until the items are completed or corrected to the satisfaction of the Architect.

§ 9.8.5.2 In no event shall the Project or portion thereof be certified as substantially complete until at least 90% of the work on the Project, or portion thereof, is complete.

§ 9.8.5.3 Intentionally deleted.

§ 9.8.5.4 Minimum Completion Threshold.
The percentage-of-completion requirement stated in Section 9.8.5.2 establishes a minimum condition precedent to consideration of Substantial Completion and does not replace or supersede the functional and operational criteria set forth in Section 9.8.1, all of which must be satisfied for certification of Substantial Completion.

§ 9.8.6 In no case shall the time established for the completion and correction of items on the list extend beyond 30 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 Work on the list or to submit documentation and items required for Final Completion and Final Payment.

§ 9.8.7 If the Contractor fails to complete or correct the items within designated timeframe for completion, then the Owner may, in its sole discretion, (a) deduct 1.5 times the estimated cost to correct or complete one, some, or all of the incorrect and unsatisfactory items from the Contract Sum and remove those items from the Contractor's scope of work, or (b) assess liquidated damages in the amount of $500 per day against the Contractor.

§ 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 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 notify the Construction Manager 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 after consultation with the Construction Manager. Contractor shall not withhold partial occupancy or use from Owner due to failure of the Contractor to complete the Work in accordance with the Contract Documents in the time stipulated in the Agreement and approved Change Orders, if any, for extension of time.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Construction Manager, 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.

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§ 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.

§ 9.9.4 As Work is completed and occupied, the Contractor shall ensure the continuing construction activities will not unreasonably interfere with the use, occupancy and quiet enjoyment of the completed portions thereof.

§ 9.9.5 The Contractor agrees to coordinate the Work with the Construction Manager, the Architect, and the Owner in order to minimize disturbance to occupied portions of the structure. In the event performances or tests are conducted in close proximity to the Work in progress, the Contractor agrees to cease all Work which may disturb the Owner's occupants.

§ 9.9.6 The Owner shall have the right to occupy and erect or place any apparatus or equipment in any part of the Project without such installation being construed as an acceptance of any of the Contractor's workmanship or materials, or as affecting any terms in the Contract. Prior, however, to the Owner taking possession, an inspection will be made by the Construction Manager, Architect, and Owner of the area and any subsequent damage due to occupancy by the Owner will not be the responsibility of the Contractor.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Construction Manager a notice that the Work is ready for final inspection and acceptance, and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager shall perform an inspection to confirm the completion of Work of the Contractor. The Construction Manager shall make recommendations to the Architect when the Work of all of the Contractors is ready for final inspection, and shall then forward the Contractors' notices and Application for Payment or Project Application for Payment, to the Architect, who will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed ("Final Completion"), the Construction Manager and Architect will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their 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 Construction Manager's and Architect's final Certificate for Payment or Project 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 through the Construction Manager (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, (6) final "as-built" prints of record drawings marked by the Contractor with record information as set forth in the Contract Documents, (7) a final Contractor's sworn statement showing all Subcontractors and material and equipment suppliers to be fully paid and similar sworn statement from Subcontractors and Sub-Subcontractors confirming that they have been paid, and (8) 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 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 Construction Manager and Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction Manager and 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

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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 through the Construction Manager prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment.

§ 9.10.3.1 If more than one inspection for Final Completion is required, the Contractor will be billed and responsible for the professional fees and services of the Architect and/or Construction Manager for performing all subsequent inspections. Following Substantial Completion, in the event the Contractor or Subcontractor fails to complete the list of items of the Work instructed by the Architect or Construction Manager to be corrected or completed within the time period set forth elsewhere in the Contract Documents or if no such time period is set forth elsewhere in the Contract Documents, then 30 days from Substantial Completion, the Owner may: (i) exercise any available remedies to correct or complete deficient Work or retain a third party to correct or complete such Work at the cost of the Contractor; (ii) retain and deduct from any payments or retention otherwise due to the Contractor any fees and expenses for services required to be provided by the Architect and/or Construction Manager; and/or (iii) recover against the Contractor and Surety under the Performance Bond, as part of its damages any and all legal fees and professional fees, jointly and severally, and all other costs and expenses incurred by the Owner in connection with the Owner's pursuit of its rights under the Contract and Performance Bond, including, but not limited to, any and all legal fees, professional fees, and all other costs and expenses related thereto. The Owner shall have the right to set off said amounts against any amount alleged to be due and owing to the Contractor under the Contract.

§ 9.10.4 The making of final payment shall not constitute a waiver of Claims by the
(Paragraphs deleted)
Owner.

§ 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 asserted in a timely manner and in accordance with the Contract Documents and specifically identified in writing as unsettled at the time of final Application for Payment.

§ 9.11 Liquidated Damages

§ 9.11.1 Liquidated damages as set forth in Article 3, Article 5, and Article 9, shall be assessed as they are incurred.

§ 9.11.2 In the event the Contractor or its Surety litigates the enforceability or imposition of liquidated damages as set forth in the Contract Documents and the Owner prevails in any part on such claim, the Contractor and its Surety shall be liable to the Owner for the Owner's costs incurred in defending the enforceability or imposition of liquidated damages, including, but not necessarily limited to, attorney's fees, expert witness fees, and consultants' fees.

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. The Contractor shall submit the Contractor's safety program to the Construction Manager for verification that the Contractor has a safety program within 10 days after Notice to Proceed. The Construction Manager's responsibilities for verification of safety programs shall not extend to any review of the adequacy of the Contractor's safety program, or control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or Subcontractors, or any other persons performing portions of the Work.

§ 10.1.1 The Contractor's safety program shall reference Federal and State OSHA standards and other rules and regulations applicable to construction activities on the Project. The Contractor's Project Safety and Health Program shall include, without limitation, as a minimum, the following:

§ 10.1.1.1 New Hire Safety and Orientation Program: Each new or reassigned employee of the Contractor shall receive a thorough safety orientation including, without limitation, employer/employee responsibilities under Federal and State OSHA regulations, ear protection in high noise level areas, respiratory protection, Safety Data Sheets (SDS), fire protection, first aid facilities, and look-out procedures on electrical equipment.

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§ 10.1.1.2 The Contractor shall furnish Safety Data Sheets (SDS) to the Construction Manager for all materials used on the Project in accordance with governmental requirements. The Contractor shall maintain one complete set of SDS for all materials used on the Project site for periodic inspection by the Owner and the Construction Manager. The SDS may be in hardcopy or electronic format, provided electronic access to the SDS does not create a barrier to access the documents. The Contractor shall be responsible for continually updating their SDS information on site and provide the Construction Manager with any revisions to the SDS. The Contractor shall be responsible for compliance with OSHA and the Hazard Communications Standard.

§ 10.1.1.3 Weekly Toolbox Safety Meetings: The Contractor shall conduct Weekly Toolbox Safety Meetings to provide employees with current safety information. Attendance is required and records must be kept on file in the Contractor's office for review.

§10.1.2 Safety

§10.1.2.1 Without limiting any other provisions regarding safety in the Contract Documents or under law, the Contractor shall take reasonable precautions for the safety of, and shall provide reasonable protection to prevent damage, injury, or loss to employees on the Work and other persons who may be affected thereby, and the Work and materials and equipment to be incorporated therein, with respect to the Work. The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons and property and their protection from damage, injury or loss, specifically including all measures necessary and as may be required to comply with the Guidance and Directives from the Commonwealth of Pennsylvania, the Centers for Disease Control and Prevention (CDC), and any other governmental agency, relating to and arising from the COVID-19 pandemic. The Contractor acknowledges and agrees that the Guidance and Guidelines referenced herein may be revised and updated from time to time, and Contractor agrees to comply with any such revisions and updates.

§10.1.2.2 If applicable and when requested by the Owner, Construction Manager, or Architect, the Contractor agrees to submit to Owner a copy of Contractor's written plan for complying with the Guidelines and Guidance Documents referenced herein, including safe-distancing measures and other mitigation measures to protect the health and safety of Contractor's employees and the general public, as well as the Directive(s) of the Pennsylvania Governor, as may be updated from time to time. Submission of the plan to Owner shall not impose upon or establish for Owner any responsibility or obligation for Contractor's work environment or work-site safety, as such responsibility and obligation is solely upon the Contractor.

§ 10.1.2.3 SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

The Contractor shall be fully informed of and shall comply with all local, state, and federal regulations for construction as amended to date, as the rules and regulations in detail apply for the Work under the Contract. All applicable rules and regulations of governing bodies are hereby made a part of these General Conditions by reference, as if written out in full within.

§ 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, the Owner's employees, representative, and building occupants, and other persons who may be affected by the Work or the Contractor's operations;
- **.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;
- **.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; and
- **.4** construction or operations by the Owner, Separate Contractors, or other Prime Contractors, Subcontractors, or Sub-subcontractors.

§ 10.2.2 The Contractor shall comply with, and give notices or reports 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. If the Contractor fails to give such notices, or fails to comply with such laws, statutes, ordinances, codes, rules, regulations, and lawful orders of public authorities, Contractor shall be liable for and shall indemnify, defend, and hold harmless Owner, Architect, and Construction Manager, and their

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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.

§ 10.2.2.1 The Contractor shall comply with Pennsylvania Act 187 of 1996 to call Pennsylvania One Call System, Inc. (800) 242-1776 prior to digging, excavating, or moving earth on the Project. The Contractor shall contract for the services of a qualified agency to assist in locating utilities on site not covered under Pennsylvania One Call System, Inc.

§ 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. The Contractor shall also be responsible, at the Contractor's sole cost and expense, for all measures necessary to protect any property adjacent to the Project and improvements therein. Any damage to such property or improvements shall be promptly repaired by the Contractor.

§ 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 provide reasonable notice to the Owner and Construction Manager and exercise utmost care and carry on such activities under supervision of properly qualified personnel. Any Work approved must be in strict compliance with state and local regulations.

§ 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, 10.2.1.3 and 10.2.1.4 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, 10.2.1.3 and 10.2.1.4. 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, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault, acts, omissions 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, Construction Manager and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site, or adjacent site, to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.7.1 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.

§ 10.2.7.2 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 from the Project site. Contractor shall provide and operate all pumps, piping and other equipment necessary to this end.

§ 10.2.7.3 The Contractor shall remove snow or ice from the Project site which may result in damage or delay.

§ 10.2.7.4 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 or 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.

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§ 10.2.8 Injury or Damage to Person or Property
If the Contractor suffers injury or damage to person or property because of an act or omission of another party, written notice of the injury or damage, whether or not insured, shall be given to the Owner and Construction Manager within a reasonable time not exceeding 21 days after first observance, otherwise, such claim shall be deemed waited by the Contractor. The notice shall provide sufficient detail to enable the other party to investigate the matter. The Owner shall not be responsible for actions or inactions of other Prime Contractors or their Subcontractors.

§ 10.3 Hazardous Materials
§ 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 hazardous 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, Construction Manager and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed consultant to verify the presence or absence of the hazardous 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. When the hazardous 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.

§ 10.3.3 To the extent covered by the Owner's applicable insurance policies, the Owner shall indemnify, defend, and hold harmless the Contractor, Subcontractors, Construction Manager, Architect, their 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, and only if, in fact the hazardous material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless by the Owner after receipt of notice from Contractor of the same, 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 not due to the fault or negligence of the party seeking indemnity or a party other than the Owner.

§ 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.

§ 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 Intentionally deleted.

§ 10.4 Emergencies
In an emergency affecting safety of persons or property, the Contractor shall act to prevent threatened damage, injury, or loss and shall immediately notify the Owner, Construction Manager, Architect, and appropriate public safety authorities (i.e., police, EMS, fire service, etc.). Extensions 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
§ 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 effective from the date of signing of the Agreement until 90 days after Final Payment except as otherwise provided below. The Contractor shall purchase and the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the Commonwealth of Pennsylvania and have an A- or better, or financial rating of X or better with the A.M. Best's Company Key Rating, Guide - Latest Edition and being, satisfactory to Owner and Architect, and which are licensed to practice business in the Commonwealth of

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Pennsylvania. The Contractor shall obtain insurance for protection from claims under workers' compensation acts and other employee benefits acts which are applicable, claims for damages because of bodily injury, including, without limitation, death, and claims for damages, other than to the Work itself, to property which may arise out of or result from the Contractor's operations or completed operations under the Contract, whether such operations be by the Contractor or by a Subcontractor or anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable. Contractor is responsible to pay any and all deductibles and/or self-insured retentions that may apply to the required insurance. The Contractor shall include the Owner, Construction Manager and Construction Manager's consultants, municipalities having jurisdiction, and the Architect and Architect's consultants, as additional insureds under the Contractor's insurance policies, except for workers' compensation, or as otherwise described in the Contract Documents. All of the Contractor's insurance policies and the Certificates of Insurance shall state that such insurance is primary and non-contributory with respect to any other valid and collectible insurance policies. The Owner and the Contractor each intend that the policies provided in response to this Section 11.1 shall protect all of the parties insured and provide primary and non-contributory coverage for losses and damages caused by the perils covered thereby. Accordingly, such policies shall state that in the event of payment of loss or damage, the insurer shall have no right of recovery against the parties named as insureds or additional insureds:

§ 11.1.1.1 Contractor shall submit to the Owner an appropriate Certificate of Insurance within the time required by the Instructions to Bidders which certifies that the Contractor is covered by insurance requirements of this Article 11. Further, Contractor fully understands that failure to timely submit the Certificate of Insurance shall give the Owner the option to withdraw the award and forfeit the Bidder's Bid Bond.

§ 11.1.1.2 The insurance required by this Section 11.1 shall be written for not less than limits of liability specified in the Contract Documents as set forth in Section 11.1.1.3 below or required by law, whichever coverage is greater. Coverages must be written on an occurrence basis with the exception of professional and environmental/pollution liability that may be written on a "claims made" basis, and shall be maintained without interruption from the date of signing of the Agreement until 90 days after the date of final payment and termination of any coverage required to be maintained after final payment and, with respect to the Contractor's products and completed operations, and any coverage written on a claims-made basis, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents. If any such insurance is due to expire during the required coverage period, the Contractor shall not permit the coverage to lapse and shall furnish evidence of continued coverage to the Owner and the Architect for record. The minimum coverage limits set forth herein shall be subject to periodic review, and Owner reserves the right to require that the Contractor increase the minimum coverage limits if, in the reasonable opinion of Owner, the minimum coverage limits become inadequate.

§ 11.1.1.3 The Contractor shall provide Commercial General Liability including, without limitation, coverage for direct operations, sublet work, personal and advertising injury, bodily injury, property damage with explosion, collapse, and underground hazard coverage (X, C, U) contractual liability, products and completed operations with limits not less than those stated below.

.1	General Aggregate per Project (Other than Products and Completed Operations)	$2,000,000
.2	Products and Completed Operations Aggregate	$1,000,000
.3	Personal and Advertising Injury	$1,000,000
.4	Each Occurrence	$1,000,000

.5 Products and Completed Operations Insurance shall be maintained for a minimum period of two (2) years after final payment and the Contractor shall continue to provide evidence of such coverage to the Owner on an annual basis during the aforementioned period.

§ 11.1.1.4 The Contractor shall provide comprehensive automobile liability insurance including, without limitation, coverage for owned, non-owned, and hired vehicles with limits not less $1,000,000 for each occurrence, bodily injury and property damage combined.

§ 11.1.1.5 The Contractor shall provide an umbrella excess liability policy written on an excess basis with minimum coverage limits not less than $11,000,000 for each occurrence and $11,000,000 in the aggregate which provides excess coverage over all underlying insurance policies. The umbrella excess liability policy shall include, without limitation, a follow form aggregate provision.

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§ 11.1.1.6 The Contractor shall provide insurance covering losses caused by pollution incidents in limits not less than those listed below, that arise from the operations of the Contractor. Insurance shall apply to bodily injury, property damage, including loss of use of damaged property or of property that has not been physically injured; cleanup costs and defense, including costs and expenses incurred in the investigation, defense, or settlement of claims.

For General Contracts, Contractor's Pollution Liability:	$1,000,000 per claim $1,000,000 aggregate
For HVAC, Plumbing and Electrical Contracts, Contractor's Pollution Liability:	$100,000 per claim $100,000 aggregate

§ 11.1.1.7 The Contractor shall provide Workmen's Compensation in the amounts and coverage as required by Commonwealth of Pennsylvania Workmen's Compensation laws and Employers Liability with the following minimum limits:

.1	Each accident	$500,000
.2	Disease, each employee	$500,000
.3	Disease, policy limit	$500,000

§ 11.1.1.8 If the Contractor stores work offsite, the Contractor shall provide insurance coverage for portions of the Work 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.

§ 11.1.1.9 None of the requirements contained herein as to the types, limits, or Owner's approval of insurance coverage to be maintained by Contractor are intended to and shall not in any manner, limit, qualify, or quantify the liabilities and obligations assumed by Contractor under the Contract Documents, any other agreement with the Owner, or otherwise provided by law.

§ 11.1.1.10 Failure of Contractor to provide insurance as herein required or failure of Owner to require evidence of insurance or to notify Contractor of any breach by Contractor of the requirements of this Section shall not be deemed to be a waiver of any of the terms of the Contract Documents, nor shall they be deemed to be a waiver of the obligation of the Contractor to defend, indemnify, and hold harmless the indemnified parties as required herein. The obligation to procure and maintain any insurance required is a separate responsibility of Contractor and independent of the duty to furnish a copy or certificate of such insurance policies.

§ 11.1.2 Contractor's Performance Bond and Payment Bond. 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 covering the Contractor's faithful performance of the Contract and payment of obligations arising thereunder. The Contractor shall purchase and maintain the required bonds from a company or companies acceptable to the Owner and lawfully authorized to issued surety bonds in the Commonwealth of Pennsylvania, and the cost thereof shall be included in the Contract Sum The amount of each Performance and Payment bond shall be equal to 100 percent (100%) of the Contract Sum. The forms contained in the Bidding Documents must be used. Other forms of bonds will not be accepted. The carriers from whom the Contractor has purchased bonds must be listed in the most recent U.S. Treasury Department Circular and authorized to conduct business in the Commonwealth of Pennsylvania with an AM Best Rating or "A-" or better and financial rating of Class "X" or higher. The amount of said bonds in question must not exceed the acceptable limit in accordance with the ratings of the surety company. The Contractor shall provide bonds in accordance with the Public Works Contracts Bond Law of 1967, 8 P.S. Sec. 191, et seq. The bonds shall be solely for the protection of the Owner or its assignee. The Surety's liability under the bonds shall be the same as the Contractor's liability.

§ 11.1.2.1 The Contractor shall deliver the required Payment Bond and Performance Bond to the Owner not later than ten (10) days after receipt of Notice of Intent to Award.

§ 11.1.2.2 The Contractor shall require the attorney-in-fact who executes the required Payment Bond and Performance Bond on behalf of the surety to affix thereto the power of attorney that is certified to be in full force and effect as of the date of the Bonds.

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§ 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.
§ 11.1.4.1 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 directly to the Owner, **Construction Manager, and Architect** 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 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.

§ 11.1.4.2 Certificates of insurance acceptable to the Owner shall be submitted to the Construction Manager for transmittal to the Owner with a copy to the Architect prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire. Written notice shall be provided to the Owner in compliance with this Section 11.1.4 in the event the Contractor's insurance expires or is cancelled within the time specified in Section 11.1.1. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by this Section 11.1. Information concerning reduction of coverage shall be furnished by the Contractor with reasonable promptness. If this insurance is written on the Comprehensive General Liability policy form, the Certificates shall be AIA Document G705, Certificate of Insurance. If this insurance is written on a Commercial General Liability policy form, ACORD Form 25 will be acceptable. Language such as "will endeavor to mail..." or "...but failure to mail...shall impose no obligation or liability...upon the company, its agents or representatives..." is not acceptable within the Cancellation Clause and should be stricken therefrom.

§ 11.2 Owner's Insurance
§ 11.2.1 The Owner shall purchase and maintain property 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.

§ 11.2.1.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.2 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project. The Contractor shall be solely liable for paying the deductible on the Owner's builder's risk insurance for the Project for any claims relating to the Contractor's Work.

§ 11.2.1.2 Property insurance shall be on an "all-risk" or equivalent policy form and shall insure against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for the Architect's, Contractor's, and Construction Manager's services and expenses required as a result of such insured loss. Coverage for other perils shall not be required unless otherwise specifically provided in the Contract Documents.

§ 11.2.2 Failure to Purchase Required Property Insurance. Intentionally deleted.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Intentionally deleted.

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§ 11.2.4 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.2.5 The insurance required by this Section 11.2 is not intended to cover machinery, tools or equipment owned or rented by the Contractor which are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools or equipment.

§ 11.3 Waivers of Subrogation
§ 11.3.1 Intentionally deleted.

§ 11.3.2 Intentionally deleted.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance
Intentionally deleted.

§ 11.5 Adjustment and Settlement of Insured Loss
§ 11.5.1 Intentionally deleted.

(Paragraph deleted)

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 Construction Manager's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by either, be uncovered for their 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 Construction Manager or Architect has not specifically requested to examine prior to its being covered, the Construction Manager or 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 unless the condition was caused by one of the other Prime Contractors in which event the other Prime Contractor shall be responsible for payment of such costs.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

In addition to the Contractor's obligations under Section 3.5, if, within one year, or such longer period of time as set forth in the Bid, after the date of Substantial Completion or designate portion thereof, the Contractor shall promptly perform all Work under the Agreement and shall promptly correct Work rejected by the Construction Manager, Owner, or 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 the Work not performed by Contractor, and costs of correcting rejected Work, including required and additional testing and inspections, the cost of uncovering and replacement, and compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.1.1 Work that is rejected or fails to conform to the requirements of the Contract Documents that requires any review, research, recommendation, meetings or direction by the Architect, any other consultants, or the Construction Manager, in order to substantiate the same or to approve remedies or alternate solutions will be subject to Section 12.2.1. The Architect, any consultants, and the Construction Manager, will be compensated for such additional Work at the prevailing rates by the Owner, who will be entitled to back charge the Contractor for such fees, as well as any legal fees, professional fees, other expenses or costs incurred. The Owner may deduct the same from any Application for Payment or any amount of retainage.

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§ 12.2.1.2 If prior to the date of Substantial Completion, the Contractor, a Subcontractor, or anyone for whom either is responsible uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

§ 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 or Architect to do so, unless the Owner or Architect has previously given the Contractor a written acceptance of such condition. The obligations under Section 12.2.2 shall survive acceptances of the Work under the Contract and termination or expiration of the Agreement. The Owner or Architect shall give such notice promptly after discovery of the condition. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner, Construction Manager or Architect, the Owner may correct it in accordance with Section 2.5. Nothing contained in Section 12.2.2 shall decrease the liability of the Contractor and its Surety as set for the in the Performance Bond and/or as required by law.

§ 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 the work will run anew from the date upon which the Contractor's completion or correction of the work is confirmed by the Architect and Construction Manager.

§ 12.2.2.4 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 2.5. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Architect, the Owner may remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within 10 days after written notice, the Owner may, upon 10 additional days' written notice, sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Architect's services and expenses made necessary thereby, and attorneys' and accountants' fees and expenses. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

§ 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 The Contractor shall bear the cost of any Work not performed or improperly performed by the Contractor.

§ 12.2.4 The Contractor shall bear the cost of correcting or addressing destroyed or damaged construction of the Owner, Separate Contractors, or other 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, or the Contractor's failure to properly perform the Work.

§ 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.

§ 12.2.6 The obligations under Section 12.2 shall cover any repairs and replacement to any part of the Work or other property caused by the defective Work.

§ 12.2.7 The Contractor will be responsible for any expense of the Owner incurred by said uncovering or repair including, but not limited to, legal fees, professional fees, other expenses, or costs.

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§ 12.2.8 Upon request by the Owner and prior to the expiration of 1 year from the date of Substantial Completion, the Architect, Construction Manager, and Contractor shall schedule and attend a meeting with the Owner to review the facilities operations and performance.

§ 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 Commonwealth of Pennsylvania without regard to conflicts of law The Contractor's attention is directed to the fact that all applicable Federal and State laws, codes, local ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Agreement throughout, and they are deemed to be included in the Agreement the same as though herein written in full..

§ 13.1.1 The Contractor shall comply with all applicable laws of the Commonwealth of Pennsylvania, including the provisions of the Solid Waste Management Act (1980) and any amendments thereto and shall comply with applicable laws of the United States, along with all local laws and ordinances, and all environmental protection acts.

§ 13.1.2 Non-Discrimination Policies

.1 The provisions of the Pennsylvania Human Relations Act, Act 222 of October 27, 1955 (P.L. 744), as amended from time to time (43 P.S. Section 951, et. seq.) of the Commonwealth of Pennsylvania prohibits discrimination because of race, color, religious creed, ancestry, age, sex, hair, national origin, or non-job related handicap or disability or the use of a guide or support animal because of blindness, deafness, or physical handicap, by employers, employment agencies, labor organizations, contractors, and others. The Contractor shall agree to comply with the provisions of the Pennsylvania Human Relations Act, as amended from time to time, which are made part of these General Conditions as if included herein at length. The Contractor's attention is directed to the language of the Commonwealth of Pennsylvania's non-discrimination clause in 16 Pa. Code Section 49.101, et seq., as amended from time to time.

.2 By Submitting a bid and executing Contract Documents, the Contractor shall be deemed to agree as follows:

(a) In the hiring of any employee (s) for the manufacturer of supplies, performance of the Work, or any other activity required under the Contract or any subcontract, the Contractor, Subcontractor, or any person acting on behalf of the Contractor or Subcontractor shall not discriminate, by reason of gender, race, creed or color in violation of the Pennsylvania Human Relations Act (PHRA) and applicable federal laws against any citizen of the Commonwealth of Pennsylvania who is qualified and available to perform the Work to which the employment relates. (62 Pa. C.S.A. Section 3701).

(b) The Contractor, any Subcontractor, or any person on their behalf shall not in any manner discriminate by reason of gender, race, creed, color, sexual orientation, gender identity or expression, or in violation of the PHRA and applicable federal laws, against or intimidate any employee involved in the manufacturer of supplies, the performance of Work, or any other activity required under the Contract. (62 Pa. C.S.A. Section 3701).

(c) Neither the Contractor nor any subcontractor nor any person on their behalf shall in any manner discriminate against employees by reason of participation in or decision to refrain from participating in labor activities protected under the Public Employee Relations Act, Pennsylvania Labor Relations Act, or National Labor Relations Act, as applicable and to the extent determined by entities charged with such Acts' enforcement, and shall comply with any provision of law establishing organizations as employees' exclusive representatives.

(d) The Contractor and Subcontractors shall establish and maintain a written nondiscrimination and sexual harassment policy and shall inform their employees in writing of the policy. The policy must contain a notice that sexual harassment will not be tolerated and employees who practice it will be disciplined. Posting this Nondiscrimination/Sexual Harassment Clause conspicuously in easily accessible and well-lighted places customarily frequented by

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employees and at or near where the grant services are performed shall satisfy this requirement for employees with an established work site.

(e) The Contractor shall not discriminate by reason of gender, race, creed, color, sexual orientation, gender identity or expression, or in violation of the PHRA and applicable federal laws, against any Subcontractor or supplier who is qualified to perform the Work to which the Contracts relates.

(f) The Contractor and each Subcontractor represents that it is presently in compliance with and will maintain compliance with all applicable federal, state, and local laws and regulations relating to nondiscrimination and sexual harassment. The Contractor and each Subcontractor further represents that it has filed a Standard Form 100 Employer Information Report ("EEO-1") with the U.S. Equal Employment Opportunity Commission ("EEOC") and shall file an annual EEO-1 report with the EEOC as required for employers' subject to Title VII of the Civil Rights Act of 1964, as amended, that have 100 or more employees and employers that have federal government contracts or first- tier subcontracts and have 50 or more employees. The Contractor or any subcontractor shall, upon request and within the time periods requested by the Commonwealth, furnish all necessary employment documents and records, including EEO-1 reports, and permit access to their books, records, and accounts by the granting agency and the Bureau of Diversity, Inclusion and Small Business Opportunities, for the purpose of ascertaining compliance with the provisions of this Section 13.1.2.

(g) The Contractor shall include, without limitation, the provisions of this Section 13.1.2 in every subcontract so that such provisions will be binding upon each Subcontractor.

(h) The Contractors' obligations pursuant to these provisions are ongoing from and after the effective date of this Contract through the termination date thereof. Accordingly, the Contractor and Subcontractors shall have an obligation to inform the Owner and Commonwealth if, at any time during the term of this Agreement, it becomes aware of any actions or occurrences that would result in violation of these provisions.

(i) The Owner, Commonwealth of Pennsylvania and its agencies may cancel or terminate the Contract for a violation of the terms and conditions of this Section 13.1.2, and all money due or to become due to the Owner under the Grant may be forfeited for a violation of the terms and conditions of this Section 13.1.2. In addition, the Commonwealth and its agencies may proceed with debarment or suspension and may place the Contractor and/or Subcontractor in the Contractor Responsibility File.

§ 13.1.3 Prevailing Wage Requirements

.1 The Pennsylvania Prevailing Wage Act (Act No. 442 of 1961, P.L. 987, amended by Act 342 of 1963, P.L. 653), and as amended from time to time (43 P.S. Section 165-1, et seq.), the regulations thereto, and the Prevailing Wage Determination Schedule included in the Contract Documents as Section 00 73 46, as determined by the Secretary of Labor and Industry (the "Secretary"), 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 the Work is performed, are expressly incorporated in these General Conditions by reference.

.2 The Contractor and Subcontractors shall pay no less than the wage rates (including contributions for employee benefits) as required by the Prevailing Wage Rate Requirements included in the Contract Documents as Section 00 73 43, to any person they respectively employ in the performance of the Work. Employers not parties to a contract requiring contributions for employee benefits which have been determined to be included in the general prevailing minimum wage rate shall pay the monetary equivalent thereof directly to the workers.

.3 The 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. The Contractor shall insert into each subcontract all of the stipulations contained in these required provisions and such other stipulations as may be required.

.4 The Contractor and all Subcontractors shall keep an accurate record showing the time, craft and/or classification, number of hours worked per day, and the actual hourly rate of wage paid (including employee benefits) to each worker employed by them in connection with the Project and such record must include, without limitation, any deductions from each worker. The record shall be preserved for two (2) years from the date of payment, or as required by Section 3.6.5.1, and shall be open at all

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reasonable hours to the inspection of the Owner and to the Secretary or the Secretary's duly authorized representatives.

.5 The Contractor and each of its Subcontractors shall comply with the requirements of Specification Section 00 73 43, Prevailing Wage Rate Requirements, for the submission of Prevailing Wage Certification Forms required for this Project.

§ 13.1.4 ALUMINUM AND STEEL PRODUCTS

.1 As this Project involves the construction, reconstruction, alteration, repair, improvement or maintenance of "public work", the Contractor shall strictly comply with all requirements of the Pennsylvania Steel Products Procurement Act, 73 P.S. Section 1881, et seq., as amended from time to time with respect to the Work, which shall include, without limitation, using steel, steel products (including machinery and equipment) or cast iron produced in the United States unless otherwise exempted therefrom in the performance of the Contract or any Subcontracts thereunder.

.2 "Steel products" are defined as products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two (2) 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 and shall include cast iron products, machinery and equipment listed in United States Department of Commerce Standard Industrial Classification 25 (furniture and fixture), 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, such product shall be determined to be a United States steel product only if at least seventy-five percent (75%) 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 if it complies with Section 165 of Public Law 97-424 (96 Stat. 2136).

.3 In accordance with Act 161 of 1982, cast iron products shall also be included and produced in the United States. Act 144 of 1984 (July 9, 1984 P.L. 674) further defines "steel products" to include machinery and equipment. Act 142 of 1980 (Oct. 5, 1980 P.L. 693), Act 161 of 1982 and Act 141 of 1984 provide clarifications and penalties and Contractor shall abide by these Acts, as amended from time to time.

.4 In addition to the requirements set forth in Section 13.1.5.1, the Contractor shall strictly comply with all requirements of the Trade Practices Act, 71 P.S. § 773.101 et seq., which shall include, without limitation, being prohibited from using any aluminum or steel products made in a foreign country which discriminates against aluminum or steel products manufactured in Pennsylvania. The countries of Brazil, South Korea, Spain, and Argentina have been found to discriminate against certain products manufactured in Pennsylvania. Therefore, the purchase or use of those countries' products, as listed herein, for the Project is strictly prohibited.

.5 BRAZIL: Welded carbon steel pipes and tubes; carbon steel wire rods; tool steel; certain stainless-steel products, including hot-rolled stainless-steel bar; stainless steel wire rod and cold-formed stainless-steel bar; pre-stressed concrete steel wire strand; hot-rolled carbon steel plate in coil; hot-rolled carbon steel sheet and cold-rolled carbon steel sheets.

.6 SPAIN: Certain stainless-steel products, including stainless steel wire rod, hot-rolled stainless-steel bars and cold-formed stainless-steel bars; pre-stressed concrete steel wire strands, 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.

.7 SOUTH KOREA: Welded carbon steel pipes and tubes; hot-rolled carbon steel plate; hot-rolled carbon steel sheet and galvanized steel sheet.

.8 ARGENTINA: Carbon steel wire rod and cold-rolled carbon steel sheet.

.9 Penalties for violation of the above Sections may be found in the Trade Practices Act, which penalties include becoming ineligible for public works contracts for a period of three years.

.10 The provisions of Section 13.1.5 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.

§ 13.1.5 RIGHT-TO KNOW LAW

The Contractor shall comply with all terms and conditions of the Pennsylvania Right to Know Act,, 65 P.S. § 67.101, et seq. ("RTKL"), and as amended.

.1 Upon notice given by Owner to Contractor that the Owner is in receipt of a Right-to-Know Request (the Request) requesting access to documents related to the Work that are not within the possession of the

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Owner or Owner's representatives, the Contractor shall provide Owner all documents regarding the Work that are determined by the Owner to be responsive to the Request (the "Record"). The Owner shall determine whether the Record constitutes a Public Record subject to disclosure under the RTKL.

.2 Upon receipt of a Request as described under Section 13.1.5.1, Owner will send a copy of the Request to the Contractor within five (5) business days of receipt of the Request for the Record. The Contractor shall provide the Owner with the Record within five (5) business days. The Contractor shall provide such other assistance as the Owner may need in order to comply with the RTKL. The Owner shall deny the Request for the Record or release the Record within the time period allotted by the RTKL.

.3 If at any time the Contractor notifies the Owner in a written statement signed by a representative of the Contractor that a document provided by the Contractor to the Owner contains a trade secret or confidential proprietary information, the Owner shall notify the Contractor within five business (5) days of receipt of a Request requesting a Record of the Contractor that contains such information. The Contractor shall have five (5) business days from the receipt of the notice from the Owner to provide input on the release of the Record. Thereafter the Owner will either deny the Request or release the Record and shall notify the Contractor of its decision.

.4 The failure by the Contractor to provide to the Owner the Record under Section 13.1.5.2 or the input under Section 13.1.5.3 within the specified time periods will be grounds for termination under Section 14.2. If the Owner denies the Request for failure of Contractor to provide the Record, and an appeal is taken from the denial, the Contractor upon demand from the Owner shall indemnify, and hold the Owner harmless from and against any damages, penalties, expenses, legal costs and fees, or other detriment or harm that the Owner may incur in connection with defense of the appeal. If on appeal, a final determination is entered by the Office of Open Records that requires the Owner to provide access to the Record, Contractor shall provide the Owner the Record in accordance with the final determination. Failure to timely provide the Record shall subject the Contractor to the payment of liquidated damages of $800 per day for each calendar day beyond the date the Record was ordered to be released.

.5 The Owner will provide the Contractor with reimbursement for costs incurred by Contractor for which Owner is allowed to charge in accordance with and within the scope of permitted costs as set forth in the fee schedule established by the Office of Open Records or as otherwise allowed under the RTKL.

.6 The Owner's determination as to whether the Record is a Public Record is dispositive of the question as between the Owner and the Contractor. The Contractor agrees not to challenge the Owner's decision or in any way hold the Owner liable for its decision. Contractor waives all rights or remedies that may be available to Contractor as a result of the Owner's disclosure of Records in response to a RTK Request. The waiver of all rights or remedies shall survive the expiration of the Contract Documents.

§ 13.1.6 Pennsylvania Uniform Construction Code

The Contractor shall comply with all requirements of the Pennsylvania Uniform Construction Code, 35 P.S. § 7210.301 – 7210.304, as amended by S.B. 1139, Session of 2004, as further amended from time to time.

§ 13.1.7 ANTI-POLLUTION LEGISLATION AND EROSION CONTROL:

.1 62 Pa. C.S.A. Section 3301 requires that Bidders on construction contracts, for the Commonwealth of Pennsylvania be advised that there are provisions of Federal and State statutes, rules and regulations dealing with the prevention of environmental pollution and the preservation of public natural resources that affect the Project on which Bids are being received.

.2 The Bidder shall become thoroughly acquainted with the terms of the listed statutes, rules and regulations, including, but not limited to, Flood Plain Management Act (32 P.S. Section 679.101, et seq.), Water Well Drillers License Act (32 P.S. Section 645.1, et seq.), Pennsylvania Scenic Rivers Act (32 P.S. Section 820.21, et seq.), Dam Safety and Encroachment Act (32 P.S. Sec. 693.1, et seq.), Bluff Recession and Setback Act (32 P.S. Section 5201, et seq.), Storm Water Management Act (32 P.S. Section 680, et seq.), Pennsylvania Sewage Facilities Act (35 P.S. Section 750.1, et seq.), Pennsylvania Solid Waste Management Act (35 P.S. Section 6018.101, et seq.), Pennsylvania Safe Drinking Water Act (35 P.S. Section 721.1, et seq.), the Clean Streams Law (35 P.S. Section 691.901 et seq. and 35 P.S. Section 691.1 et. seq.), Air Pollution Control Act (35 P.S. Section 4001, et seq.), Pennsylvania Historic Preservation Act (37 Pa. C.S.A. Section 501, et seq.), Pennsylvania Hazardous Sites Clean Up Act (35 P.S. Section 6020.101, et seq.), Pennsylvania Storage Tank and Spill Prevention Act (35 P.S. Sec. 6021.101, et seq.), Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. Sections 9601-9675) as amended, including, but not limited to, the Superfund Amendments

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and Reauthorization Act (P.L. 99-499), Federal Solid Waste Disposal Act (42 U.S.C. Sections 6901-6992), Federal Clean Air Act (Air Pollution Act) (42 U.S.C. Sections 7401-7671q), Federal Safe Drinking Water Act (See Public Health Service Act Sections 1401-1451) (42 U.S.C. Sections 300f-300j-11), Wild and Scenic River Act (P.L. 90-542), Endangered Species Conservation Act of 1969 (P.L. 89-669), Endangered Species Conservation Act of 1973 (16 U.S.C. Sections 1531-1544), Federal Clean Water Act of 1977 (P.L. 95-217), Rivers and Harbor Act of 1970 (P.L. 91-611), Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. Sections 136-136y), Toxic Substance Control Act (15 U.S.C. Sections 2601-2692), Resource Conservation and Recovery Act of 1976 (42 U.S.C. Sections 6901-6991), Coastal Wetlands Planning, Protection and Restoration Act (16. U.S.C. Sections 3951-3956), Coastal Zone Management Act of 1972 (16 U.S.C. Sections 1451-1464), Community Environmental Response Facilitation Act (42 U.S.C. Section 9620), Emergency Planning and Right-to-Know Act of 1986 (42 U.S.C. Sections 11001-11050), Energy Supply and Environmental Coordination Act of 1974 (15 U.S.C. Sections 791-798), Environmental Quality Improvement Act of 1970 (42 U.S.C. Sections 4371-4375), Federal Facility Compliance Act of 1992 (42 U.S.C. Section 6901), Federal Land Policy and Management Act of 1976 (43 U.S.C. Sections 1701-1784), Federal Water Pollution Control Act (33 U.S.C. Sections 1251-1387), Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. Sections 1101-1164), Global Climate Protection Act of 1987 (15 U.S.C. Section 2901 note), Hazardous Substance Response Revenue Act of 1980 (see 26 U.S.C. Sections 4611, 4612, 4661, 4662), Lead-Based Paint Exposure Reduction Act (15 U.S.C. Sections 2681-2692), Lead Contamination Control Act of 1988 (42 U.S.C. Sections 300j-21 to 300j-25), Low-Level Radioactive Waste Policy Act (42 U.S.C. Sections 2021b-2021d), National Climate Program Act (15 U.S.C. Sections 2901-2908), National Contaminated Sediment Assessment and Management Act (33 U.S.C. Section 1271 note), National Environmental Policy Act of 1969 (42 U.S.C. Sections 4321-4370b), National Ocean Pollution Planning Act of 1978 (33 U.S.C. Sections 1701-1709), Noise Control Act of 1972 (42 U.S.C. Sections 4901-4918), Oil Pollution Act of 1990 (33 U.S.C. Sections 2701-2761), Pollution Prevention Act of 1990 (42 U.S.C. Sections 13101-13109), Public Health Service Act (42 U.S.C. Sections 300f-300j-11), Renewable Resources Extension Act of 1978 (16 U.S.C. Sections 1671-1676), Resource Conservation and Recovery Act of 1976 (42 U.S.C. Sections 6901-6991), Soil and Water Resources Conservation Act of 1977 (16 U.S.C. Sections 2001-2009), Water Resources Research Act of 1984 (42 U.S.C. Sections 10301-10309), Wood Residue Utilization Act of 1980 (16 U.S.C. Sections 1681-1687), Pennsylvania Worker and Community Right-to-Know Act (35 P.S. Section 7301, et seq.), Asbestos Hazard Emergency Response Act of 1986 (see Toxic Substances Control Act Sections 201-214) (15 U.S.C. Sections 2651-2654), Delaware River Basin Compact (32 P.S. Section 815.101, et seq.), Brandywine River Valley Compact (32 P.S. Section 818, et seq.), Wheeling Creek Watershed Protection and Flood Prevention District Compact (32 P.S. Section 819, et seq.), Susquehanna River Basin Compact (32 P.S. Section 820.1, et seq.), Chesapeake Bay Commission Agreement (32 P.S. Section 820.11, et seq.), Land and Water Conservation and Reclamation Act (32 P.S. Section 5101, et seq.), Wild Resource Conservation Act (32 P.S. Section 5301, et seq.), Cave Protection Act (32 P.S. Section 5601, et seq.), Rails to Trails Act (32 P.S. Section 5611, et seq.), Phosphate Detergent Act (35 P.S. Section 722.1, et seq.), Plumbing System Lead Ban and Notification Act (35 P.S. Section 723.1, et seq.), Publicly Owned Treatment Works Penalty Law (35 P.S. Section 752.1, et seq.), Pennsylvania Solid Waste-Resources Recovery Act (35 P.S. Section 755.1, et seq.), Sewage System Cleaner Control Act (35 P.S. Section 770.01, et seq.), Hazardous Material Emergency Planning and Response Act (35 P.S. Section 6022.101, et seq.), Oil Spill Responder Liability Act (35 P.S. Section 6023.1, et seq.), Land Recycling and Environmental Remediation Standards Act (35 P.S. Section 6026.101, et seq.), Radiation Protection Act (35 P.S. Section 7110.101, et seq.), Low-Level Radioactive Waste Disposal Act (35 P.S. Section 7130.101, et seq.), Pennsylvania Municipalities Planning Code (53 P.S. Section 10101, et seq.), regulations, ordinances, and other actions pursuant to the foregoing, regulations pertaining to Pennsylvania Erosion and Sediment Control, and so on. No separate or additional payment will be made for such compliance. In the event that the listed statutes, rules and regulations are amended, or if new statues, rules 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 setting forth the additional Work that must be undertaken and such additional Work shall be undertaken at no additional cost to the Owner. It is also the responsibility of the Contractor to determine what local ordinances, if any, will affect their portion of the Work. The Contractor 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

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addition, for any rules or regulations of other organizations having jurisdiction, including, without limitation, 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 prices bid, even though documents of such local controlling agencies are not listed herein.

.3 Erosion Control

(a) To the extent the Contractor performs excavation Work, it shall comply with all rules and regulations of Chapter 102, Title 25 of Pennsylvania Soils Erosion and Sedimentation Control (25 Pa. Code Section 102.1, et seq.). Prior to any grading, the Contractor shall be responsible to obtain approval from the Department of Environmental Protection and local Conservation District having jurisdiction for an approved sedimentation and erosion control site plan for the Project site and shall perform all necessary site work in accordance with said plan. The applicable plan shall be available at the Project site at all times. If the Contractor performs excavation work, it shall maintain all devices as required to control erosion caused by storing water and preventing dust and particles from being distributed off site.

(b) Site Excavation: The Contractor shall:

1) request the location and type of facility owner lines at the Project site by notifying the facility owner through the One Call System as defined in 73 P.S. § 176. Notification shall be not less than three (3) business days nor more than ten (10) business days in advance of beginning excavation or demolition work. No work shall begin earlier than the scheduled excavation date which shall be on or after the third business day after notification. The scheduled excavation date shall exclude the date upon which notification was received by the One Call System and notification received on a Saturday, Sunday, or holiday, which shall be processed on the following business day. In the case of a complex project as defined in 73 P.S. § 176, notification shall not be less than ten (10) business days in advance of the beginning of excavation or demolition work.
2) provide the One Call System with specific information to identify the Project site so that facility owners might provide indications of their lines.
3) take reasonable steps to work with facility owners including, without limitation, scheduling and conducting a preconstruction meeting, so that the Contractor may locate the facilities at a time reasonably in advance of the actual start of excavation or demolition work for each phase of the Work if the Project is a complex project as defined in 73 P.S. § 176 or if an excavation Contractor intends to perform work at multiple sites or over a large area. After commencement of excavation or demolition work, the excavation Contractor shall be responsible for protecting and preserving the staking, marking or other designation until no longer required for proper and safe excavation or demolition work at or near the underground facility, or by contacting the One Call System to request that the facilities be marked again in the event that the previous markings have been compromised or eliminated.
4) comply with the requirements established by the One Call System as determined by the board of directors regarding the maximum area that a notification may cover.
5) inform each operator employed by the excavation Contractor at the Project site of the information received with respect to location and type of underground installations and any other information required by 73 P.S. § 176, et. seq.
6) report immediately to the Owner, Construction Manager, and the Architect, any break or leak on its lines or any dent, gouge, groove, or other damage to such lines, to their coating or cathodic protection, made or discovered in the course of the excavation or demolition work.
7) immediately notify 911 and the facility owner if the damage results in the escape of any flammable, toxic or corrosive gas or liquid which endangers life, health or property.
8) assist a facility owner in determining involvement of a facility owner's lines by disclosing additional available information requested by the facility owner, including, without limitation, dimensions, and the direction of proposed excavations.

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9) re-notify the One Call System unless other arrangements have been made directly with the facility owners involved at the Project site if the excavation Contractor removes its equipment and vacates the Project site for more than 2 business days.
10) submit an incident report to the Department of Labor and Industry of the Commonwealth of Pennsylvania not more than 10 business days after striking or otherwise damaging a facility owner's line during excavation or demolition activities that resulted in personal injury or property damage to parties other than the affected excavation Contractor or facility owner.
11) comply with all requests for information by the Department of Labor and Industry of the Commonwealth of Pennsylvania relating to such Department of Labor and Industry's enforcement authority under the 73 P.S. § 176, et. seq. within 30 days of the receipt of the request.
12) .ensure the accuracy of the information provided to the One Call System pursuant to 73 P.S. § 176, et. seq.
13) .become thoroughly acquainted with and comply with all other terms and conditions specified in 73 P.S. § 176, et. seq., as amended from time to time including, without limitation, the Contractor shall pay all applicable fees.
14) complete the site excavation in full compliance with all applicable standards, codes, laws, ordinances, regulations and/or requirements of any applicable State, Federal or governmental agency.

§ 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, Construction Manager, 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.

§ 13.3.3 In the event the Contractor should breach any obligation imposed by the Contract Documents, in addition to all other damages, losses, costs and relief, whether in law or equity, which the Owner may recover, the Owner shall also be entitled to an award for any reasonable legal fees, expert witness fees, and consultant fees incurred in attempting to enforce or recover under the Contract Documents by reason of the Contractor's breach. The Owner's right to recover under the Contract Documents, at law or in equity, shall not be restricted to the rights and remedies set forth in Article 15 of these General Conditions. To the extent the Contractor pursues any claims against the Owner and the Owner substantially prevails on any of its claims or defenses, the Contractor shall pay the Owner all legal fees, professional fees, expert witness fees, and other costs incurred by the Owner in defending or bringing such claims. Nothing contained herein shall be construed to provide the Contractor or any other person or entity the right to claim such costs or expenses.

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§ 13.3.4 In the event that the Owner declares the Contractor in default and the Contractor's Surety fails to adhere to its obligations under the Performance Bond or Payment Bond, the Surety shall be liable to the Owner for any and all damages that the Owner incurs including, but not limited to, any attorney's fees, professional fees, or other costs or expenses incurred by the Owner in connection with the Owner's pursuit of its rights under the Performance Bond, Payment Bond and/or applicable law, including the cost of all litigation, including but not limited to, attorney's fees, professional fees, and costs.

§ 13.3.5 To the extent any Contractor sues the Owner, and the Owner prevails in such litigation, the Contractor shall be responsible for all of the Owner's damages, costs and expenses including but not limited to, any and all professional fees or expert witness fees (e.g., Architectural fees, Construction Management fees, and legal fees).

§ 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. The Contractor shall make arrangements for and conduct or obtain such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals including, without limitation, the cost of retesting for verification of compliance if necessary, until the Architect or the Construction Manager certify(ies) that the Work in question does comply with the requirements of the Contract Documents, and all such costs shall be included in the Contract Sum. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until the Agreement is executed. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require. At the Owner's option, the Owner may retain a field-testing agency or other testing agencies for this Project, as the Owner deems necessary, in its sole discretion.

§ 13.4.2 If the Construction Manager, 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 Construction Manager and 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 Construction Manager and Architect of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense. At the Owner's option, the Owner may retain a separate entity to perform the additional testing, inspection, or approval not included under Section 13.4.1.

§ 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 Construction Manager's and Architect's services and expenses, shall be at the Contractor's expense. Such amounts will be deducted, to the extent available, from any amount due the Contractor. If the amount due the Contractor is not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner within 7 days of receipt of the Owner's invoice for such legal fees, professional fees or other cost or expenses.

§ 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 Construction Manager for transmittal to the Architect.

§ 13.4.5 If the Construction Manager or Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Construction Manager or 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.

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§ 13.5 Interest
Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate of 3% simple interest per annum, as set for the in Article 5.3 of the AIA, A132-2019, Standard Form of Agreement between Owner and Contractor..

§ 13.6 Interpretations
§13.6.1 The captions and headings of various Articles and Section in the Contract Documents are for convenience only and are not to be construed as defining or limiting, in any way, the scope or intent of the provisions hereof.

§ 13.6.2 The invalidity of any covenant, restriction, condition, limitation or any other part or provision of the Contract Documents shall not impair or affect in any manner the validity, enforceability, or effect of the remainder of the Contract Documents.

§ 13.6.3 References to Sections or paragraphs shall also be deemed to include the respective Subparagraphs.

§ 13.6.4 The parties hereto expressly waive the defense of contra proferentem, i.e., that the Contract Documents or any portion of the Contract Documents may be construed against any party as the drafter thereof.

§ 13.7 Employment Policies
§ 13.7.1 The Contractor shall maintain policies of employment as follows:

§ 13.7.1.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment, or recruitment advertising; lay-off 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 setting forth the policies of nondiscrimination.

§ 13.7.1.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

§ 13.8 Owner's Right to Attorney's Fees and Costs
§ 13.8.1 Intentionally deleted.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor
§ 14.1.1
(Paragraphs deleted)
Intentionally deleted.

(Paragraphs deleted)
§ 14.2 Termination by the Owner for Cause
§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** 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** disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;
- **.4** otherwise materially breaches of a provision of the Contract Documents;
- **.5** submits an Application for Payment, sworn statement, Waiver of Lien, Affidavit or document of any nature whatsoever which it intentionally falsified; or
- **.6** 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 against the Contractor and such Petition is not dismissed

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within 60 days of the day of said filing; or if the Contractor admits, in writing, its inability to pay its debts generally if they become due, or if Contractor makes a general assignment for the benefit of the creditors, or if a Receiver, Liquidator, Trustee or Assignee is appointed on account of Contractor's bankruptcy or insolvency; or if the Receiver of all or any substantial portion of the Contractor's property is appointed.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, after consultation with the Construction Manager, 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, the Contract 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.

§ 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, except as provided in Section 14.2.4.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds all costs to the Owner of completing the Work, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, such excess shall be paid to the Contractor less Owner's costs for completing the Work as of the date of termination. If such costs and damages to the Owner of completing the Work exceed the unpaid balance of the Contract Sum, the Contractor shall pay the difference to the Owner immediately upon Owner's demand. The cost to the Owner of completing the Work shall include (but not be limited to) the cost of any additional architectural, construction management, managerial and administrative services required thereby, any costs incurred in retaining another Contractor or other Subcontractor to complete the Work, any additional interest or fees which the Owner may incur by reason of the delay in completion of the Work, attorney's fees and expenses incurred by the Owner, and any other damage, costs and expenses which Owner may incur by reason of completing the Work or any delay thereof. The amount, if any, to be paid to the Contractor shall be certified by the Initial Decision Maker after consultation with the Architect upon application, in the manner provided in Article 9.4 .

§ 14.2.5 Notwithstanding any other provision of the Contract Documents to the contrary, in the event that the Contractor abandons its Work on the Project, as determined by the Owner in its sole discretion, and the Contractor does not resume its Work after 72 hours prior written notice from the Owner, the Owner may terminate the Contractor for cause without such termination being subject to the Initial Decision Maker's certification required by Section 14.2.2. The Owner's rights set forth in this Section 14.2.5 shall be in addition to all other rights of the Owner granted in the Contract Documents, at law, or in equity.

§ 14.2.6 In the event the Owner elects to terminate the Contractor for cause, the Owner may recover against the Contractor and Surety as part of its damages any and all legal fees, professional fees, jointly and severally, including, but not limited to, Architectural fees, Construction Management fees, expert witness and consultant fees, legal fees, and all other costs and expenses related thereto. The Owner shall have the right to set off said amounts against any amount alleged to be due and owing to the Contractor on the base amount of the Contract. Further, should the Contractor fail to achieve Final Completion promptly, upon written recommendation by the Architect and upon notice to the Contractor and after reasonable opportunity to cure, the Owner may, for cause, terminate the Contractor, complete the Work, and recover against the Contractor or Surety, any and all amounts that the Owner incurs, including, but not limited to, any and all legal fees, professional fees and all other costs and expenses related thereto. This provision shall create no right to the Contractor or to any other person or entity for payment of such costs or expenses.

§ 14.2.7 In the event that the Owner declares the Contractor in default and the Contractor's Surety fails to adhere to its obligations under the Performance Bond and Payment Bond, the Surety shall be liable to the Owner for any and all damages that the Owner incurs including, but not limited to, any legal fees, professional fees, or other costs or expenses incurred by the Owner in connection with the Owner's pursuit of its rights under the Performance Bond and Payment Bond and/or applicable law, including, but not limited to, the cost of all litigation, legal fees, professional fees, and all other costs and expenses.

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§ 14.2.8 In the event that the Owner terminates the Contract for cause pursuant to Section 14.2 and a court of competent jurisdiction determines that cause for termination did not exist, then the termination shall be treated as a termination for convenience pursuant to Section 14.4 and the Contractor shall be compensated in accordance with Section 14.4.3.

§ 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 In such event, if applicable, the Contractors shall be entitled to an equitable extension of Contract Time pursuant to Section 8.3.1 caused by the suspension, delay, or interruption under Section 14.3.1.
(Paragraphs deleted)
The Contractor shall not be entitled to any adjustment in the Contract Sum.

§ 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.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work completed by the Contractor in accordance with the Contract Documents. The Contractor shall not be entitled to receive more than $10,000 for compensation, including, without limitation, for field and office overhead or profit (e.g., expected or actual profit) for Work not executed, termination expenses, or damages. In case of such termination of the Contract for the Owner's convenience, Contractor shall be entitled to receive payment from the Owner only for Work which has been certified by the Architect as having been completed by the Contractor.

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 Contractor shall commence all Claims and causes of action against the Owner related to the Contract Documents, whether in contract, tort, or otherwise, within six (6) months of Project completion unless a shorter time applies pursuant to the terms of this Agreement. The Contractor acknowledges that the Owner is a Pennsylvania Public School District and the doctrine of *nullum tempus occurrit regi* applies to its construction, maintenance and repair of school buildings.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Except as provided herein, claims by the 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 written notice to the Owner and to the Initial Decision Maker with a copy sent to the Architect. Claims by the Contractor 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 Contractor first recognizes the condition giving rise to the Claim, whichever is later. The Contractor shall provide written notice of the claim to the Owner in accordance with the requirements set forth herein. The words "written notice" shall be defined as a letter of claim with a title or a caption stating, "Notice of Claim" and shall provide a description of the claim, shall reference related correspondence and/or directives and/or

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other relevant documents, and the cost and/or time impact of the claim to the Contractor. Provided however, that Claims by the Owner or the Contractor arising from or relating to the Owner's termination of the Contractor's services under Article 14 of this Agreement shall neither be submitted to, nor shall be subject to initial review and decision by, the Initial Decision Maker. If not resolved by the parties, such Claims be subject to dispute resolution under the further provisions of this Article 15.

§ 15.1.3.2 Intentionally deleted.

§ 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 for undisputed amounts in accordance with the Contract Documents.

§ 15.1.4.2 The Construction Manager or Architect will prepare Change Orders and the Construction Manager will issue a Certificate for Payment or Project Certificate for Payment in accordance with decisions 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 Work. No claims for additional costs will be considered for delays caused by the Contractor or other Contractors, coordination issues, project schedules, phasing sequence, or time extensions due to weather or other unforeseen circumstances. Claims for such delays shall be limited to claims for increase in the Contract Time.

§ 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 herein shall be given before proceeding to execute the Work. The Contractor's Claim shall include an estimate of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary. The Contractor's sole recourse for delays is included in Section 8.3 on these General Conditions.

§ 15.1.6.2 No extension of time shall be granted because of seasonal or abnormal variations in temperature, humidity or precipitation, which conditions shall be wholly at the risk of the Contractor, whether occurring within the time originally scheduled for completion or within the period of any extension granted. Any additional costs of operations or conditions shall be the responsibility of the Contractor.

§ 15.1.6.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work, and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

§ 15.1.6.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

§ 15.1.7 Claims for Consequential Damages and/or Incidental Damages. The Contractor waives all Claims against the Owner for consequential and/or incidental damages arising out of or relating to this Contract This waiver includes, but is not limited to:

- **.1** consequential damages incurred by the Contractor for office expenses, including without limitation, personnel stationed there, 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 for loss of actual and expected profit.
- **.2** incidental damages incurred by the Contractor for principal office expenses including, without limitation, costs resulting from stopping the Work, removing and transporting the Contractor's property (e.g., the Contractor's equipment, supplies and materials), and storing the Contractor's property (e.g., the Contractor's equipment, supplies and materials) at an alternate location.

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This waiver is applicable, without limitation, to all consequential damages and/or incidental 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 or the Owner's recovery of consequential or incidental damages permitted under applicable laws.

§ 15.1.8 Construction Acceleration Claims

No claim for an increase in the Contract Sum or change in the Contract Time shall be based on construction acceleration. Accordingly, no course of conduct or dealings between the parties, or any express or implied statements made by the parties, nor any express or implied acceptance of alterations to the Work, and no claim that the Owner has been unjustly enriched by any alteration or addition to the Work, whether or not there is in fact any such unjust enrichment, shall be the basis for any claim to an increase in the Contract Sum or change in the Contract Time.

§ 15.1.9 Claims for Economic Loss

The Contractor shall have no claim or right of recovery of damages against the Owner, the Architect and/or the Construction Manager for economic loss sustained, in whole or in part, by any act or omission of the Owner, the Architect and/or the Construction Manager to the extent that such act or omission constitutes a breach of contract. Specifically, and without limiting the generality of the foregoing, the Contractor shall have no claim against the Owner, the Architect and/or the Construction Manager for economic loss based upon any tort, including, without limitation, negligence, negligent misrepresentation, or any other tort-based theory of liability.

§ 15.2 Initial Decision

§ 15.2.1 Claims between the Owner and Contractor, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker. An initial decision shall be required as a condition precedent to dispute resolution proceedings related to that of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no 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 and the Contractor and the Owner shall equally share the expense relating to the retention of such persons.

§ 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, the Construction Manager, 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 the dispute resolution process set forth in the Contract Documents.

§ 15.2.6 When a written decision of the Architect states that (1) the decision is final but subject to litigation and (2) filing of a lawsuit or a claim covered by such decision must be made by the Contractor within 30 days after the date on which the Contractor receives the final written decision, then the Contractor's failure to file suit within said 30 days' period shall result in the Architect's decision becoming final and binding upon the Contractor. If the Architect renders

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a decision after litigation proceedings have been initiated, such decision may be entered as evidence, but shall not supersede litigation proceedings unless the decision is acceptable to all parties concerned.

§ 15.2.6.1 Intentionally deleted.

§ 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 Intentionally deleted.

§ 15.2.9 To the extent any Contractor asserts frivolous claims or asserts claims in bad faith, and the Owner incurs any legal fees, professional fees, expert witness fees, expenses, costs (including, but not limited to, employee cost), the Contractor shall be liable for such fees, expenses or costs, and the Contractor shall reimburse the Owner for such legal fees, professional fees, costs and expenses immediately upon demand by the Owner. This provision shall create no right to the Contractor of any other person or entity for payment of such costs or expenses.

§ 15.3 Mediation

§ 15.3.1 Any claims, disputes, or other matters in question arising out of or related to the Contract, shall be subject to non-binding mediation, but only upon mutual agreement of the Owner and Contractor.

§ 15.3.2 The Owner and Contractor mutually agree to proceed to non-binding mediation, they shall agree upon a forum for the mediation.

§ 15.3.3 Intentionally deleted.

§ 15.3.4 Intentionally deleted.

§ 15.4 Dispute Resolution

§ 15.4.1 If the Owner and Contractor do not mutually agree to proceed to non-binding mediation, or if the parties do not resolve their dispute in non-binding mediation, then the parties, including the Contractor's surety, agree to have any claims, disputes or other matters in question arising out of or relating to this Agreement, decided by the Court of Common Pleas of Montgomery County, Pennsylvania. The parties, including the Contractor's surety, hereby submit to the exclusive jurisdiction of said Court and further agree that the venue of said Court shall be proper in all respects.

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SECTION 00 73 19 - SAFETY

PART 1 - GENERAL

1.01 OVERVIEW

A. The personal safety and health of all workers at the project site is of primary importance. The prevention of occupationally induced injuries/illnesses and the compliance with regulatory requirements will be given precedence over operating productivity whenever necessary.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.
B. 00 72 00 General Conditions of the Contract.
C. 01 33 00 Submittal Procedures

1.03 SUBMITTALS

A. Submission of the following is required prior to commencement of work and per 01 33 00 Submittal Procedures.

1. Site Specific Safety Plan including process for weekly toolbox talks
2. Silica Plan (if your scope of work creates silica concerns, this must be included)
    a. Proper training documentation to be included.
3. Fall Protection Plan (if your work will require any activity above 6', lifts, roof work, etc.)
    a. A Competent Person must be identified along with proper training documentation.
4. Steel/Pre-cast Erection Plan (must be specific to this project)
5. Crane and pick plan if applicable (certification of crane operator & rigger)
6. Trench / Excavation Safety (if your scope will be trenching or have open excavations this is required)
    a. A Competent Person must be identified along with proper training documentation.
7. Confined Space Plan (if your scope requires work in a confined space, this is required)
    a. Proper training documentation to be included.

8. Hot Work Plan (if your scope requires hot work, this is required)
    a. Must also include training documentation and example of hot work permit.
9. COVID 19 Preparedness Plan
10. SDS Sheets
    a. Must be readily available (identify the process i.e., paper copies, smartphone, etc.)

1.04 OUTLINE OF RESPONSIBILITIES

A. Each Contractor is responsible for compliance with all applicable governmental safety regulations for their operations, and the coordination of safety precautions with other Contractors on-site.
B. Each Contractor shall appoint an on-site safety representative who is responsible for administering the Contractor's safety program and has the authority to act on behalf of the Contractor on safety issues.
C. The Contractor's on-site safety representative shall train and instruct their employees, attend project safety meetings, immediately supervise the correction of unsafe acts or conditions, investigate all accidents and injuries involving Contractor employees and conduct weekly safety meetings with their employees.
D. Each Contractor shall submit a written report of all accidents causing personal injury or property damage to Construction Manager's Project Manager within 24 hours of their occurrence. The report must include the date and time of the occurrence, damage to equipment or work, names of injured employees, nature of injury, description of the accident/incident and what will be done to prevent the accident/incident from happening again.
E. A Construction Manager representative or their 3rd party consultant will periodically evaluate contractor safety activities and performance in conjunction with each Contractor safety representative. Non- conforming activities or performance shall be corrected by the Contractor immediately."
F. The use of alcohol or drugs by workers on-site is strictly prohibited.
G. Each Contractor shall maintain the construction site and building premises in a clean and orderly manner, in conformity with all governmental regulations, OSHA standards and recommendations.
H. Reference Article 10 of the General Conditions of the contract for other Contractor safety responsibilities.

1.05 SAFE WORK PRACTICES

A. Any condition or practice that a worker observes that might cause personal injury or damage to equipment should be reported to his supervisor immediately.
B. Workers shall not operate any equipment that, in their opinion, is not in safe working condition.
C. Trade Contractors shall ensure that their employees who operate any equipment have been trained & authorized by Trade Contractor and supply this information to the CM upon request.

D. All prescribed safety and personal protective equipment must be used when warranted and said equipment shall be maintained in good working condition. Boots, hard hats and class 2 safety vests must be worn at all times. Eye protection and ear protection shall be available and ready to use when there is a hazard exposure i.e. cutting, grinding, etc.
E. Radios will be allowed at a reasonable level; however, earbuds will not be allowed.
F. Trade Contractors shall train their employees in proper lifting techniques.
G. Trade Contractors engaged in, but not limited to, excavation, scaffolding, fall protection, etc. shall identify their respective competent person (OSHA 1926.32(f) to Construction Manager prior to the commencement of their work.
H. Horseplay will not be permitted on the project.
I. Any Trade Contractor whose employees use powder actuated tools must train their employees in their safe operation, and each employee using such tools shall carry certification that they have been properly trained.
J. Trade Contractors shall not move or disable access/egress lighting. Each Trade Contractor shall provide his own task lighting.
K. Each Trade Contractor shall be responsible to install guardrails, toe boards, etc.
L. Shirts shall be worn at all times. Shirts with sleeves less than 4" or that do not fully cover the torso are not permitted. Tennis shoes (or soft soled shoes) shall not be worn on-site.
M. The use of all tobacco products on public property is prohibited and will be strictly enforced.
N. The use of alcohol or drugs by workers on site is absolutely prohibited. Any worker who violates this policy or is found to be impaired by alcohol or drugs shall be immediately removed from the site by his employer. The Owner or Construction Manager shall have the authority to direct a Trade Contractor to remove a worker from the site.

    1. Drug or alcohol "use" means consuming, possessing, distributing, concealing, buying, or selling, being under the influence, or reporting for duty while under the influence of alcohol or drugs to any degree.
    2. The term "alcohol or drugs" means any form of alcohol or other intoxicating beverage and every type of drug, narcotic plant, or similar narcotic substance, whether illegal or not. Workers who are taking prescription drugs in accordance with a valid prescription must advise their supervisor. The supervisor must determine whether any work restrictions are appropriate. The supervisor shall notify the Project Superintendent of any such work restrictions.

O. Each Trade Contractor shall ensure that their employees are trained and knowledgeable of the specifics of this Safety Policy and must attend safety orientation prior to them working.
P. Trade Contractors violating the Safety Policy will be issued via Procore a "Safety and Health Violation Observation" as warranted by the Project Superintendent. All violations must be corrected immediately and responded to in Procore.
Q. No tools or equipment will be allowed on-site if factory installed or supplied guards and safety devices have been removed, altered, or not used.
R. Warning signage applicable to operations being performed shall be posted prior to commencing work i.e., lasers in use, controlled access to roof, etc.

S. All contractors shall provide current OSHA approved asbestos awareness training to all of its employees prior to jobsite mobilization. Contractors shall include certification of this training in their jobsite specific Safety Manual.

T. Contractors are strongly encouraged to conduct daily pre-task plans to help identify potential safety risks and methods to mitigate them.

1.06 ENFORCEMENT

A. Contractors or employees failing to comply with safety requirements shall be subject to disciplinary action. Disciplinary action could include, but is not limited to the following:

1. Removal of a Contractor, Sub-Contractor, or employee from the site.
2. Reduction or withholding of progress payments until safety violations are corrected.
3. Payment of costs for correction of a safety hazard created by the Contractor when an imminent safety hazard exists, or when previous notices are not adequately responded to.
4. Termination of the contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 00 73 19

SECTION 00 73 43 - PREVAILING WAGE RATE REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Prevailing Wage Act.
2. Pennsylvania Department of Labor and Industry “Weekly Payroll Certification for Public Works Projects” Form LLC-25 follows as Section 00 73 44.
3. Pennsylvania Prevailing Wage Determination Schedule follows as Section 00 73 46.

1.03 Prevailing Wage Rates

A. The general provisions of the Pennsylvania Prevailing Wage Act, approved August 15, 1961, as amended are applicable to this project.
B. 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.
C. 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 approved August 15, 1961 (Act No. 442), as amended August 9, 1963 (Act No. 342), and the Regulations issued pursuant thereto, to assure the full and proper payment of said rates. Contact PA Department of Labor and Industry for clarification of any classification of workers.
D. 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.
E. The Contractor shall insert in each of his subcontracts all of the stipulations contained in these required provisions.
F. 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.

G. 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.

H. 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:

1. Name of project.
2. Name of public body of which it is constructed.
3. The crafts and classifications of workmen listed in the Secretary's general prevailing minimum wage rate determination for the particular project.
4. The general prevailing minimum wage rates determined for each craft and classification and the effective date of any changes.
5. 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.

I. 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.

1. 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.

J. 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.

K. 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.

L. 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.

M. The provision of the Act and the Regulations are incorporated by reference in the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

A. Prevailing wage certification forms are to be produced weekly and are to be submitted monthly. Prevailing wage certificates are to be sent to Architect and CM with a pencil copy of the Application for Payment. No Applications for Payment will be processed without the proper prevailing wage certificates. Contractor may be requested to submit the prevailing wage certification forms in any of the following manners:

1. If hard paper copies are submitted, Contractor shall submit two (2) copies of each prevailing wage certification form.
2. If digital copies are submitted, Contractor shall submit to Architect and CM in PDF form.
3. Redacted certified payroll:

    a. Prevailing wage certification forms submitted to the Owner may not be redacted by law; however, if there is a Project Right-to-Know request, the Contractor will be required to submit redacted prevailing wage certification forms **in addition** to the required unredacted forms. The following information may be redacted:

        1) Employee Name
        2) Employee Address
        3) Employee Social Security Number

B. Contractor shall use the Commonwealth of Pennsylvania Department of Labor and Industry Form LLC-25 (form can be accessed at: http://www.dli.pa.gov/Individuals/Labor-Management-Relations/Documents/llc-25.pdf), as revised from time to time, and ensure proper classification of workmen are assigned to each person. Certificates must be filled out in their entirety. Form is included as Specification Section 00 73 44. Certified Payroll submitted on U.S. Wage and Hour

Division forms are NOT accepted and will be returned to the Contractor.

C. Regardless of the submission type, the first and the final certification forms must be notarized, signed, and dated.

END OF SECTION 00 73 43

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., _____

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project Name:	Jarettown Elementary
General Description:	New construction of 87,000 sqr ft elementary school. Includes new parking, lot, fields, storm water infrastructure, and demolition of existing school.
Project Locality	Upper Dublin , PA
Awarding Agency:	ICS Consulting
Contract Award Date:	12/21/2026
Serial Number:	26-09035
Project Classification:	Building/Highway
Determination Date:	10/13/2026
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: 26-09035 - 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: 26-09035 - 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: 26-09035 - 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: 26-09035 - 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: 26-09035 - 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: 26-09035 - 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

SECTION 00 91 00 – ADDENDA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. The Construction Manager may prepare and issue Addenda during the bidding period as necessary to interpret or clarify the bidding documents, to list approved substitutions of materials or systems, or to change the date and/or time for receipt of bids.
B. Addenda will refer bidders to the affected drawings or section of the project manual and describe the modification, clarification, or correction in writing or by means of supplemental drawings if necessary.
C. Addenda will be serially numbered and dated, identifying the Project, Owner, Construction Manager, and Engineer(s).
D. Addenda will be distributed electronically, by email, or mail to all known bidders at the address furnished by them when bidding documents were obtained. Copies of the Addenda will be distributed at the same time to all parties recorded as having bidding documents on file.
E. Bidders shall not rely on oral instructions made to bidders by any officer, agent, or employee of the Owner, Construction Manager, or Engineer(s).

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION 00 91 00

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by the Contract Documents.
3. Work performed under Owner's separate contracts.
4. Owner-furnished products.
5. Construction schedule.
6. Responsibility of the Contractor.
7. Use of building by Owner.
8. Contractor's use of premises

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 01 73 00 "Execution" for coordination of Owner-installed products.

1.03 PROJECT INFORMATION

A. All work furnished under this Project Manual shall be installed at the following location in accordance with the Contract Documents:
B. Project Identification: New Jarrettown Elementary School

1. Project Location: 1520 Limekiln Pike Dresher, PA 19025
2. Applicable County: Montgomery County
3. Applicable Local Municipality: Upper Dublin Township

C. Owner: Upper Dublin School District, 1580 Fort Washington Ave., Maple Glen, PA 19002
D. The provisions of the General Conditions, and Divisions 00, Procurement and Contracting Requirements and Division 01, General Requirements, shall apply to all work of the Contracts.

E. The Scope of Work for the Prime Contractors includes all work required for complete construction of their Work Scope in accordance with the Contract Documents.

1.04 WORK COVERED BY THE CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. New building construction
2. Environmental Abatement (to be completed under a separate prime contract)
3. Demolition
4. Associated site work

B. Project will be constructed under coordinated, concurrent multiple prime construction contracts. See Section 01 12 00, Multiple Work Scope Summary for list of multiple contracts requirements and coordination, including responsibilities of the Project Coordinator. See individual Work Scope Summary Sections for a description of Work included under each of the multiple contracts. A summary of Work Scope packages currently being bid are as follows:

1. Work Scope 1 –General Construction and related site work

a. Work Scope No. 1 includes all labor, materials, equipment, supervision, coordination, services, and incidental work required to provide the complete construction of the building and associated improvements as shown in the Contract Documents. The Specification Divisions specifically assigned to this Contract are Divisions 00 through 14 and 31, 32, and 33 except when specifically assigned to another Contract for construction. The General Construction Contract shall also perform all work shown, specified, indicated, scheduled, or reasonably inferable from the Contract Documents necessary for a complete and functional installation, regardless of the drawing discipline, specification section, drawing sheet designation, or detail in which the work is referenced, except where expressly assigned to another Contract. Work Scope No. 1 includes demolition, sitework, architectural, structural, food service, and all other activities customarily recognized as general construction.

2. Work Scope 2 –Electrical Construction

a. Work Scope No. 2 includes all labor, materials, equipment, supervision, coordination, services, and incidental work required to provide the complete construction of the building and associated improvements as shown in the Contract Documents. The Specification Divisions specifically assigned to this Contract are Divisions 00, 01, 02, 03, 04, 07, 08, 10, 11, 12, 14, 22, 23, 26, 27, 28, 31 and 33 except when specifically assigned to another Contract for construction. The Electrical Construction Contract shall also perform all work shown, specified, indicated, scheduled, or reasonably inferable from the Contract Documents necessary for a complete and functional installation, regardless of the drawing discipline, specification section, drawing sheet designation, or detail in which the work

is referenced, except where expressly assigned to another Contract. Work Scope No. 2 includes all construction and other activities customarily recognized as electrical construction.

3. Work Scope 3 –Mechanical Construction

   a. Work Scope No. 3 includes all labor, materials, equipment, supervision, coordination, services, and incidental work required to provide the complete construction of the building and associated improvements as shown in the Contract Documents. The Specification Divisions specifically assigned to this Contract are Divisions 00, 01, 02, 03, 04, 07, 11 and 23 except when specifically assigned to another Contract for construction. The Mechanical or HVAC Construction Contract shall also perform all work shown, specified, indicated, scheduled, or reasonably inferable from the Contract Documents necessary for a complete and functional installation, regardless of the drawing discipline, specification section, drawing sheet designation, or detail in which the work is referenced, except where expressly assigned to another Contract. Work Scope No. 3 includes all construction and other activities customarily recognized as mechanical or HVAC construction.

4. Work Scope 4 – Plumbing/Fire Protection Construction

   a. Work Scope No. 4 includes all labor, materials, equipment, supervision, coordination, services, and incidental work required to provide the complete construction of the building and associated improvements as shown in the Contract Documents. The Specification Divisions specifically assigned to this Contract are Divisions 00, 01, 02, 03, 04, 07, 11, 12, 21, 22, 31, and 33 except when specifically assigned to another Contract for construction. The Plumbing Construction Contract shall also perform all work shown, specified, indicated, scheduled, or reasonably inferable from the Contract Documents necessary for a complete and functional installation, regardless of the drawing discipline, specification section, drawing sheet designation, or detail in which the work is referenced, except where expressly assigned to another Contract. Work Scope No. 4 includes all construction and other activities customarily recognized as plumbing and fire protection construction.

1.05 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:

   a. Conducted by a separate firm hired by the Owner and will require the participation and cooperation of all Contractors.

b. The Owner will procure and bear costs for only the following: field testing for earthwork, concrete, masonry, asphalt and concrete paving, fireproofing and firestopping, and structural steel.

2. Commissioning Verification Authority and HVAC Testing, Adjusting, and Balancing (CVA/TAB):

a. Conducted by a separate firm hired by the Owner and will require the participation and cooperation of all contractors.
b. The Mechanical Contractor is responsible for all pressure testing of any pipes, ductwork, or field systems and for coordinating and supporting all the testing and balancing.

3. Playground Equipment:

a. Conducted by a separate firm hired by the Owner and will require coordination with the Work Scope 1 General Construction Contractor
b. The General Construction Contractor is responsible for all playground base and site prep

4. Limekiln Road Improvements:

a. Conducted by a separate firm hired by the Owner and will require coordination with all contractors
b. See drawings for distinction of where the property sitework ends, and the Limekiln Road improvements begin.

5. Environmental Abatement:

a. Conducted by a separate firm hired by the Owner and will require coordination with all contractors

6. Other contracts are at the Owner’s sole discretion

1.06 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products. 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 with 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 Products:

1. Security cameras and equipment provided by the Owner will be installed under Work Scope No. 2.
2. Residential/Kitchen Appliances
3. Kitchen Appliances as indicated on drawings to be provided by the Owner will be installed under Work Scope No. 1.
4. CCTV System
5. TV displays as indicated on the drawings to be installed under Work Scope No. 2.
6. Other items as noted in the drawings.

1.07 CONSTRUCTION SCHEDULE

A. Scheduling of Work and Time of Completion is an essential condition of this Contract. The entire Work shall be completed in compliance with the Project milestone completion dates listed. Any deviations from these requirements shall be subject to the approval of the Construction Manager.
B. The Notice to Proceed will be issued as noted on the Phasing Plan(s).
C. Completion for each phase and milestones are noted on the Phasing Plan and must be strictly complied with.
D. Completion of all contracts is as follows:

1. Building Substantial Completion: June 21st, 2029
2. Site Substantial Completion: February 27th, 2030
3. Project Final Completion: March 27th, 2030

E. See Phasing Plan(s) for milestone dates. The contractors' sequence and CPM schedule shall incorporate all milestone dates and comply with all dates noted therein for completing the Project. The dates provided are the milestone completion dates which will be enforced. All building systems are to be installed in compliance with the milestone dates identified on the Phasing Plans.

F. Construction work shall be performed in a sequence to ensure that all building systems are systematically installed in an efficient manner. The mechanical and electrical rooms shall be constructed in an early sequence to permit rough-in by the Mechanical, Electrical, and Plumbing trades and to ensure proper operation of life safety systems in occupied areas of the building in the timeframes identified on the Phasing Plans.

G. If the Notice to Proceed or a required permit or an approval from an approval agency that is required for Start of Work is delayed for any reason beyond the control of any Prime Contractor that prevents the Contractor from Performing Work, the Owner, in consultation with the Construction Manager, may adjust the applicable Milestone Completion Dates, Phased Completion Dates, and Contract Time as deemed appropriate to account for the delay. The Contractor is not entitled to damages for delay of any type on this contract. Contractor agrees that an extension of time is the only resource as a result of any delays that are beyond the Contractor's control.

H. If a specific milestone or phased completion date is delayed for any reason beyond the control of any Prime Contractor that prevents the Contractor from performing Work, and the delay impacts subsequent milestone and phased completion dates, remaining milestone and phased completion dates will be adjusted by the exact same number of days.

I. All Work must be completed in accordance with the Phasing Drawings, the Project NPDES permit requirements for stormwater discharges associated with construction activities issued under Chapter 102 by the Department of Environmental Protection (DEP) and authorized county conservation districts (CCDs), the approved Project schedule, and in a sequence approved by the Architect, Engineer, and Owner. Each prime contractor shall complete and submit required Visual Site Inspection Reports (VSIRs) and other DEP compliance documentation in compliance with the Owner's NPDES permit and DEP requirements and shall submit the appropriate application forms to the appropriate County Conservation District.

1.08 RESPONSIBILITY OF THE CONTRACTOR

A. The Contractor shall be responsible for the scheduling and general management of the work of the project and for the acts and omissions of all of their employees; all subcontractors, their agents and employees; and all other persons performing any of the work under a contract with the Contractor.

B. The Contractor will have supervision on site full-time during the duration of the project for their respective scope of work. The Supervisor must be on site while all work is in process.

C. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work.

D. The Contractor shall supervise and direct the work, using their best skills and attention. They shall be solely responsible for all construction means, methods, techniques and procedures and for coordination of all portions of the work under this Contract.

E. The Contractor shall accept the project as it exists. All existing conditions, whether or not specifically noted on the Contract Documents, shall be verified by the Contractor in-person prior to the start of work.

F. The Contractor shall not proceed with any items of the work, which are reasonably questionable without consulting the Construction Manager.

G. Contractor's questions regarding this project must be directed to the Construction Manager. The Owner's employees are not authorized to make decisions or give direction regarding any aspect of this project. Consult CM employees involved in the project only. These employees will be identified in the Pre-Construction Meeting. Contact information can also be obtained on Procore in the directory

H. Construction Limits: Except as specifically indicated or as may be necessary to complete the work under the Contract, activities of the Contract shall be limited to within the limits designated on the drawings.

I. Testing:

1. Contractors are to perform all factory, Source Quality Control, 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. Contractors are to perform any other field testing that may be required by Specification Divisions 02-33 or not included by the Owner’s Testing Agent.
5. All contractor testing shall be performed in the presence of the Construction Manager and/or (if required) in the presence of the municipal agency having jurisdiction.

J. The Contractor responsible for installation of the systems and equipment is responsible for commissioning each system. The minimum commissioning requirements in accordance with specific project requirements, including coordination and verification, shall be the responsibility of the Contractor.

K. Construction Waste Management for all Project activities except demolition is by Construction Manager. Construction Waste Management for demolition work and any site features is by the Contractor performing the Work.

L. Local Municipal Approvals & Permits: The Contractor shall be responsible for the final completion of the permit applications and coordinating the submission of the permit application. The Owner will pay for the building permit. The Contractor shall secure and pay for all necessary administrative costs, insurances, business privilege licenses, certifications, or taxes to apply for the necessary permits required to perform the Work.

M. Contractors must obtain all necessary state, county, or local municipal approvals prior to substantial completion.

N. Prior to acceptance as substantially complete, all general construction, all mechanical, electrical, and plumbing systems shall be complete, fully operational, tested as required, inspected by approval authorities, and certified complete.

1.09 USE OF BUILDING BY OWNER

A. Owner reserves the right to let other contracts in connection with this Project or in connection with existing buildings. Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and execution of their work and shall properly connect and coordinate his work with theirs. 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.

B. The owner reserves the right to jointly occupy the premises with the Contractor in the performance of his duties and functions. The Owner also reserves the rights to: enter into the Project and premises at all times; make installations or removal of materials and equipment at appropriate times as the Work progresses; and install or remove equipment, furniture, and furnishings when spaces are at appropriate stages of completion. Contractor shall coordinate work with the Owner and cooperate with the Owner to minimize undue interferences.

C. If any part, unit, phase, or the entire Project is substantially complete or ready for occupancy, the Owner may, upon notice to the Contractor, enter into and make use of the Work that is substantially complete.

D. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.

1. 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 CONTRACTOR'S USE OF PREMISES

A. General: During the construction period, the Contractor shall have limited use of the premises for construction operations as shown in the project plans. The Contractor's use of the premises is limited by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project, and by the Owner’s right to continue daily school operations. The Contractor must coordinate activities and cooperate with adjacent uses including any of their construction activities. Contractor must also schedule, coordinate, and perform construction activities to avoid disruption of ongoing operations. Contractor must schedule and perform certain work on weekends and holidays to avoid disruptions. This may include street and utility work.

1. The site is currently occupied as an Elementary School, and such daily activities/functions revolving around the educational process, cannot be interrupted and must be considered in the scheduling of work for this project. The Contractor is responsible to make accommodations to not disrupt regular school activities/functions, such as: (arrival/dismissal, physical education, etc.). In addition, the Contractor is required to provide adequate safety measures and separation of any and all construction activities.
2. Construction deliveries are not permitted from 8:30-9:30am and 3:15-4:15pm Monday-Friday. Any deliveries arriving at these times will be turned away with all associated costs the responsibility of the contractor.
3. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
4. Keep driveways, parking lots, and entrances serving the premises clear and available to the Owner at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

5. Site Protection: Protect existing trees and other plantings which are not to be removed, and paved surfaces which are to remain and are susceptible to damage from ordinary operations of the Contractor, trucking or other activity. Provide appropriate safety signage and barricades to keep unauthorized person(s) out of the project area.

B. Restoration: All improvements on or about the site and adjacent property which are not shown to be altered, removed or otherwise changed, and which have been damaged or disturbed by any work or operations under this contract, shall be restored to the conditions which existed previous to starting work. All features labeled to remain shall be protected from damage by any operation in connection with the Project. The Contractor shall replace or repair, at their own expense (and to the satisfaction of the Owner), all damage to existing drives, lawns, plants, trees, shrubbery and other property resulting from work of this Contract, from whatever cause.

C. Interior Protection: Each contractor/ Work Scope is responsible for protecting their installed components/materials. Finished Flooring must be covered with poly and high traffic areas (corridors, lobbies, etc.) should be covered with poly and Masonite to protect the flooring by the General Contractor. The flooring protection must be monitored and corrected if showing signs of deterioration. If damage occurs, that contractor will be responsible to clean and if that is not sufficient it will be replaced by the contractor at their expense. Contractor is to cover owner items with poly while construction activity is taking place in that room, ie; bookshelves, desks, etc. When working in a clean room, ie; computer lab or data closet, contractor is to maintain cooling, and dust free environment as to not damage equipment, Temporary enclosures may be needed to protect equipment.

END OF SECTION 01 11 00

SECTION 01 12 00 – MULTIPLE WORK SCOPE SUMMARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 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 00 Section “Safety” for responsibilities of individual Prime Contractors’ Health and Safety Plans including disease communication protocols established by CDC and OSHA.
2. Division 01 Section 01 11 00 "Summary of Work" for the Work covered by Contract Documents and for overall work sequence and for work restrictions for use of the Project site and for requirements for continued Owner occupancy of premises.
3. Division 01 Section 01 31 00 "Project Management and Coordination" for general coordination requirements.
4. Division 01 Section 01 31 17 “Coordination Drawings” for specific drawing coordination requirements and responsibilities.
5. Division 01 Section 01 50 00 "Temporary Facilities and Controls" for specific requirements for temporary facilities and controls.

1.03 CONTRACT REQUIREMENTS APPLICABLE TO ALL WORK SCOPES

A. Comprehensive Scope of Work: Provide labor, material, and equipment necessary to properly execute the work of this Work Scope in accordance with Contract Documents and specifically the specifications sections listed herein.

1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. i.e., daily site clean-up from all contractors of work areas.
2. Each contractor is responsible for the general, civil, structural, architectural, mechanical, and electrical notes as they relate to your Work.
3. It is the intent of this Work Scope and responsibility for this contractor to provide a complete operational assembly/system, unless specifically indicated below.
4. Review the entire project so that proceeding, concurrent, and succeeding work of

other contractors can proceed without harm to the Project as a whole.

5. Each contractor is required to coordinate their work with other contractors, as directed by the Construction Manager, without additional compensation.
6. By submitting your Proposal/Bid, each contractor acknowledges they have reviewed all appropriate contract documents, including previously issued documents and have anticipated, based on information provided or available, impact of future Work as it affects their Work Scope Category.
7. Construction Cleaning: Each Work Scope is responsible for clean-up of debris, rubbish and other similar items resulting from their operations on a daily basis.

B. Contract Scope and Assigned Responsibilities:

1. Anything contained in the Contract Documents designated as "by General Contractor", “Contractor”, or similar terms, shall be by the Contractor performing the same work as so designated by the work scope delineation.
2. Local Trade union jurisdictional settlements do not control the scope of work included in a Work Scope, and Work Scopes do not delineate jurisdictional portions of work. In case a jurisdictional dispute arises, the contractor shall be responsible for any associated cost of the “Claimed” work.
3. When a potential jurisdictional dispute or similar interruption of construction activities is identified, affected contractors shall promptly negotiate a reasonable settlement with the Construction Manager and affected parties to avoid or minimize interruption and delays.
4. Unless otherwise indicated, Work Scopes include a complete section of Work, including but not limited to labor, materials, equipment, scaffolding, hoisting, applicable permits and taxes as required by the Contract Documents.

C. Clarification: The Specifications are written in imperative and abbreviated form.

1. It shall be clearly understood that all imperative statements are directed at the subcontractor responsible for that portion of the Work, unless specifically indicated otherwise.
2. Incomplete sentences shall be completed by inserting “shall”, “contractor shall”, and similar mandatory phrases by inference in the same manner as they are applied to notes on Drawings.
3. The words “shall be” shall be supplied by inference where a colon is used within a sentence or phrase.
4. Where stated “Provide” in Work Scopes. Provide means furnish and install.
5. Each Contractor is responsible for the protection of their work.
6. Temporary Facilities and Controls: See specific responsibilities for temporary facilities and controls indicated in Division 01 Section "Temporary Facilities and Controls," and as noted on the Contract Documents.

    a. Temporary enclosures of window and door openings will be completed as outlined in Section 01 50 00.
    b. Fire Extinguishers and appropriate signage will be supplied as per Section 01 50 00.

D. Interpretations or Corrections of Contract Documents: Carefully study and compare Documents with each other and with other work being performed concurrently or

presently under construction to the extent that it relates to the Work for which this Contract is awarded. Contractor shall examine the site and local conditions and shall at once report to the Construction Manager inconsistencies or ambiguities discovered or requirements not understood.

1. Using Request for Information (RFI) on the web-based project management platform (Procore, as provided by ICS), contractors shall submit to ICS Request for Information prior to performing work in question.
2. The Contractor will forward Request for Information on form acceptable to Owner, Architect, and Construction Manager prior to performing work in question. All RFIs should be submitted through Procore.
3. Responses provided to an RFI by Owner, Architect or Construction Manger are intended to be clarifications only and are not an authorization for a Contract Time extension or an increase in the Contract Amount.
4. If the contractor believes the response is a change in either Contract Time or Contract Amount, the contractor shall comply with requirements of the Owner/Contractor Agreement.
5. Request for Information (RFI's) agreed to by Owner and ICS that change either the Contract Time or Contract Amount will be included in an appropriate Change Order prior to performing work in question.

E. Conflicts and Duplication in Work: In the case of a duplication of scope responsibility either on Drawings, Specification, or Work Scope Descriptions, Contractor is responsible to bid the work as called out regardless of potential oversight duplications.

1. In the case of duplication, the Construction Manager will make the final decision as to which Work Scope will do the work and the appropriate cost adjustment will be made. Duplicated scope shall be resolved as follows:

    a. Before work is performed, the Construction Manager will determine in writing which single Work Scope will perform the duplicated work. The Construction Manager will base this on the Contract Documents and the trade responsible for the work.
    b. The Contractor not assigned the work shall receive a deductive credit. The credit equals the cost for that work shown in its Bid, as supported by its schedule of values or bid breakdown. Credits shall be issued by Change Order.
    c. The assigned Contractor will perform the work for the amount included in its Bid. No additional compensation or time extension will be allowed for performing duplicated work.
    d. A Contractor who finds duplicated scope shall notify the Construction Manager in writing before performing the work. Work performed before the Construction Manager's written determination is at the Contractor's risk.

1.04 SCOPE CLARIFICATIONS APPLICABLE TO ALL WORK SCOPE CATEGORIES

A. Extent of Contract: Unless the Contract Documents contain a more specific description of the Work, names, and terminology on Drawings and 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 required 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 01 73 29 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.

B. Special Coordination and Scheduling Required: Contractor acknowledges that the performance of this Work Scope must be closely interfaced with the performance of others and that multiple mobilizations will be required.

1. It is understood that punctuality and compliance with agreed-upon deliveries is of the essence on the Project.
2. Comply with Project Schedule and ensure preparatory work of other trades are erected first or carried forward simultaneously where installation sequence requires it.
3. Contractor shall provide reasonable notice of its intentions to those affected, and if other contractors, after such reasonable notice, fail to have their work in readiness, Construction Manager shall be consulted, and their directions followed.
4. Where indicated or required to maintain a Project Schedule or to accommodate Owner’s on-going operations, provide required “after-hours” shift work to maintain Project Schedule. It is the contractor’s responsibility to properly staff and accommodate where necessary to maintain the schedule. Overtime work by each contractor necessary to conform with these requirements shall be considered a normal practice under this contract. No claims for additional compensation will be accepted by the Owner.

1.05 COORDINATION

A. Project Coordinator shall be responsible for coordination between the General Construction Contract, Plumbing Contract (also referenced as PC), HVAC (also referenced as Mechanical and or MC) Contract, Electrical Contract (also referenced as EC), Environmental (Asbestos) Abatement Contract (also referenced as EAC) and Limekiln Road Improvements Contract.

1. General Construction Contractor shall act as and assume responsibilities of Project Coordinator which are designated throughout the Contract Documents.

B. All Prime Contractors shall cooperate and be responsible for preparation and compliance with coordination drawings per Specification 01 31 17.
C. Environmental Abatement Contractor (EAC) shall coordinate all work in accordance with project phasing requirements and scheduled activities of all other contractors.
D. The Limekiln Road Improvement Contractor shall coordinate all work in accordance with project phasing requirements and scheduled activities of all other contractors.
E. GC shall coordinate all work in accordance with project phasing requirements and scheduled activities of all other contractors.
F. GC shall perform cutting and patching of all roofing materials including metal deck. Any structural reinforcement required is by the General Contractor.
G. Refer to Article 1.07.I for roofing and watertightness responsibilities..

1.06 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:
i. Initial Coordination Meeting: At the earliest possible date, arrange and conduct a meeting with contractors for sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.
j. 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.

1) Submit schedules for approval.
2) Distribute copies of approved schedules to Architect, Construction Manager, Owner, and contractors.

k. Provide quality-assurance and quality-control services specified in Section 01 40 00 "Quality Requirements."
l. Coordinate sequence of activities to accommodate tests and inspections and

coordinate schedule of tests and inspections.

m. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.
n. 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.
o. Provide field surveys of in-progress construction and site work.
p. 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. No center pile is permitted.
q. Provide final cleaning of the building and site.
r. Coordinate cutting and patching.
s. Coordinate protection of the Work.
t. Coordinate firestopping.
u. Coordinate completion of interrelated punch list items.
v. 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.
w. Collect Record Specification Sections from other contractors, collate Sections into numeric order, and submit a complete set.
x. 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.

2. 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.

a. Coordination activities of HVAC, Plumbing, and Electrical Coordinators include, but are not limited to, the following:
b. Schedule and sequence HVAC, plumbing, electrical, and general construction activities.
c. Coordinate sharing access to workspaces by HVAC, electrical, and plumbing contractors.
d. Coordinate integration of HVAC, electrical, and plumbing work into limited spaces.
e. Coordinate protection of HVAC, electrical, and plumbing contractors' work.
f. Coordinate cutting and patching for HVAC, electrical, and plumbing work.
g. Prepare HVAC, electrical, and plumbing Coordination Drawings.
h. Coordinate tests and inspections for HVAC, electrical, and plumbing work.
i. Coordinate HVAC, electrical, and plumbing temporary services and facilities.
j. Refer to Section 013117, Coordination Drawings for specific requirements.

3. EAC Coordinator: Full-time Environmental Remediation Coordinator shall be experienced in coordination of environmental remediation construction, including coordination of type of operations required for this Project.

a. Coordination activities of EAC Coordinator includes, but is not limited to, the following:
b. Schedule and sequence environmental remediation construction activities.
c. Coordinate sharing access to workspaces with other contractors.
d. Coordinate tests and inspections of environmental remediation work.
e. Coordinate environmental remediation construction temporary services and facilities.

B. Submittal and Fabrication Time Requirements: In accordance with Part 1 of individual specification sections requiring Submittals and Division 01 requirements: coordinate, prepare, and submit a complete package of design submittals in accordance with the Project Schedule and requirements of the Subcontract Agreement.

1. Schedule Requirements for Design Submittals: Durations will be mutually agreed between the Construction Manager, Architect, and this contractor for the task identified herein and will be specifically listed within the Agreement.

a. Preparation of Design Submittals.
b. Fabrication and Delivery Time.
c. Duration of On-Site Installation.

2. Deadline: Durations shall be agreed in writing within fourteen [14] calendar days after Notice to Proceed, or before the Contractor's first design submittal is due, whichever is earlier.
3. Default durations: If durations are not agreed by that date, the durations in the Project Schedule issued by the Construction Manager apply. The Contractor will have been given a reasonable opportunity to comment on them.
4. For items requiring “design submittals” prepare submittals for review and acceptance by the A/E to comply with the milestone dates outlined within the Project Schedule and Agreement.
5. For items NOT requiring “design submittals” and upon return of approved submittals for those items requiring submittals, fabricate and deliver items to Site to comply with Project Schedule and Agreement.

C. Document Management and Control Procedures: Ensure on-site contractor’s personnel have current contract documents, including, but not limited to: Specifications, Drawings and clarifications (RFI’s and ASI’s) and other modifications (PR’s and field orders) affecting the Work.

1. Contractor is responsible to copy and distribute (at their cost) sufficient copies of documents to contractor personnel, vendors, and suppliers.
2. Ensure field personnel are familiar with requirements of Contract Documents.
3. Contractor to have an established document control procedure to ensure compliance.

D. Coordinate Layout and Clearances: Coordinate space requirements and installation for items that are indicated diagrammatically on Documents.

1. Follow routing indicated for pipes, ducts and wiring, place runs parallel with line of building. In finished areas, unless expressly indicated otherwise, conceal pipes, ducts and wiring within construction. Coordinate locations of plumbing and

electrical fixtures and electrical outlets with finish elements.

2. Use space efficiently to maximize accessibility for other installations, maintenance, and repairs.
3. Installing entities shall modify their installations, if needed, to eliminate conflicts and achieve effective coordination of systems and work.
4. Contractor's failure to exercise coordination responsibilities constitutes a waiver of claims for an increase in Contract Sum if design modifications are required to resolve conflicts that might have been avoided by complying with requirements of this Section and the overall provided schedule.

E. Field Verification of Existing Conditions and Substrates: Inspect existing conditions and substrates to receive work prior to installation, field verify dimensions that will affect the layout or performance of your work, and confirm preparatory work is complete and acceptable to receive work of this Work Scope.

F. Professional Errors and Omission Insurance Requirements: Where Work Scope Categories included requirements for "Delegated Design", "third party engineering", "Signed Shop Drawings by licensed engineer", or "submission of design calculations" as part of the individual specification sections or structural notes, refer to Insurance Requirements in the General Conditions for additional requirements.

G. Substitutions: Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with the remainder of the Work.

H. The Contractor responsible for installation of the systems and equipment is responsible for commissioning each system. The minimum commissioning requirements in accordance with specific project requirements, including coordination and verification, shall be the responsibility of the Contractor.

1.07 MULTIPLE PRIME COORDINATION CLARIFICATIONS

A. The disconnection and/or reconnection of existing equipment shall be by the Plumbing/ HVAC/ Electrical Contractor as applicable.

B. Interior concrete bases and pads required for plumbing, fire suppression, heating, ventilation, air conditioning, and electrical equipment shall be provided by the contractor installing the equipment unless noted otherwise.

C. General Contractor shall provide all exterior concrete pads and bases with exception of exterior light bases, generator pad, duct bank, cooling tower pad, and transformer pad. Exterior light pole bases, generator pads, transformer pads, and duct bank are by the Electrical Contractor. Cooling tower pad is by the Mechanical Contractor.

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. Each Prime Contractor is responsible for patching all their work penetrations made to the masonry system.

F. 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 where indicated in the Contract Documents.

G. Each Prime Contractor is responsible for patching all their work penetrations made to the metal panel system.

H. 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. Roofing and Watertight Conditions: The General Contractor, through its Roofing Subcontractor, is responsible for all roofing, flashing and roof cutting and patching, including at roof curbs. Responsibilities for maintaining watertight conditions are as follows:
    a. Roof system and curb flashing: The GC is responsible for the permanent and temporary roofing and flashing up to and including the curb flashings. The HVAC Contractor lays out all openings and curbs and furnishes fully assembled roof curbs to the GC for installation. The GC provides and installs blocking and accessories for the curbs.
    b. Equipment openings: The HVAC Contractor is responsible for keeping any temporary or permanent equipment opening watertight, and for sealing it, until the new equipment is installed and sealed.
    c. Pipes, conduits and other penetrations: Each Prime Contractor is responsible for sealing its own pipes, conduits and roof penetrations. Each Prime provides watertight temporary enclosures for its openings until the GC's Roofing Subcontractor has installed the permanent flashing. The Roofing Subcontractor then installs the permanent flashing at those penetrations.
    d. Cutting and patching: The Roofing Subcontractor cuts and patches roof materials only after the Prime Contractor requiring the opening has located and marked it in writing. The Prime Contractor is responsible for water damage that results from penetrations it did not coordinate or mark.
3. Damage and back-charges: Water damage caused by a Contractor's opening, penetration or temporary enclosure is the responsibility of that Contractor. The GC will notify the responsible Contractor in writing and back-charge it for repair costs.
4. General Contractor shall apply sealant around wall mounted outside air intake louvers provided and installed by the HVAC Contractor.
5. 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.
6. General Contractor shall furnish and install all lintels and structural supports required for openings and recesses in new and existing construction to allow the passage of the Work of his Contract and the Work of the Plumbing/Fire Protection,

HVAC, and Electrical Prime Contracts.

7. 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. The 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 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.
8. 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.
9. Plumbing, HVAC, and Electrical Prime Contracts shall furnish and install any access panels which are required for access to their work. Coordinate opening requirements with the General Contractor.
10. HVAC Contractor to furnish and install all exterior vents and louvers.
11. General, Plumbing, HVAC, and Electrical Contractors shall disconnect items of food service equipment scheduled for non-reuse, relocation, or reuse.
12. Food Service Equipment Interface Responsibilities: The General Contractor, including its Food Service Equipment and Roofing Subcontractors, shall furnish the items below, and each Contractor shall install or connect them as follows:

    a. Dry contacts (for interconnection with the building alarm):

        1. Furnished by the General Contractor.
        2. Installed and connected to the building alarm system by the Electrical Contractor.

    b. Mounting curbs and pipe portals:

        1. Furnished and installed by the General Contractor.

    c. Roof flashing at curbs and portals:

        1. Furnished and installed by the General Contractor's Roofing Subcontractor.

    d. Drain pan:

        1. Furnished by the General Contractor.
        2. Installed, with final connections, by the Plumbing Contractor

13. Electrical Contractor shall provide electrical service and connection of food service equipment, operable partitions, and auxiliary equipment.
14. Plumbing Contractor shall provide water and sewer connections to food service and auxiliary equipment.
15. 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.
16. 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.

17. Electrical Contractor shall provide devices, wiring within casework, and final connections for educational casework as provided for in the Contract Documents.
18. Plumbing, HVAC, and Electrical Contractors are responsible for sealing their penetrations in the elevator shaft
19. Elevator subcontractor is responsible for operating the elevator cart for Plumbing, HVAC, and Electrical contractor work in the shaft.
20. 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.
21. Plumbing Contractor shall make all final connections and shall provide valved connections to make-up water feeders to loop water system and dual temperature system, as indicated.
22. Plumbing Contractor shall make final connections on gas-fired equipment as indicated including all kitchen equipment, water heaters, and emergency generator.
23. General Contractor shall provide domestic and fire suppression water supply system to 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 from 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.
24. 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”.
25. HVAC and Plumbing Contractors shall provide control interlock wiring for their associated system equipment.
26. 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.
27. 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.
28. 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.
29. The Electrical Contractor shall furnish duct smoke detectors. The Mechanical Contractor shall install duct detector in ducts. The Electrical Contractor shall wire the duct smoke detectors to the fire alarm system. The Electrical Contractor shall provide fire alarm relays adjacent to the mechanical equipment, and the Mechanical Contractor shall wire to the ATC/BAS system to de-energize the fan.
30. 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.
31. 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.

32. HVAC Contractor shall set controls, panelboards, and appurtenances installed in pipelines and ductwork and shall provide control wiring.
33. 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.
34. 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.
35. 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.
36. 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.
37. 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.
38. General Contractor shall provide sanitary and storm sewer system to 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 from 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.

    a. General Contractor shall provide gravity sewer line from 5' outside of the building to manhole or holding tanks as noted on civil drawings. General Contractor to provide and install all cleanouts and covers outside of the building. Plumbing Contractor to provide sewage ejector and piping to 5' outside of the building and final connection to the gravity sewer line.
    b. General Contractor shall provide exterior stormwater conveyance including exterior gutters, downspouts, and leaders to below grade, and tie-in to stormwater conveyance system including all required accessories including but not limited to cleanouts, boots, etc.
    c. 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.

39. If the Utility company is not responsible for providing the gas service installation

and connection to the building meter, then the 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 to final connection point as indicated on the Contract Documents. All work to be in accordance with Utility specifications and requirements.

40. Plumbing Contractor shall provide all gas service piping throughout building and shall make final connections to equipment.
41. General Contractor is responsible for the final cleaning described in specification 01-74-00 Final Cleaning.

1.08 MATERIAL HANDLING AND STORAGE

A. Delivery and Receiving of Materials: Provide labor and equipment necessary to receive materials, unload, inspect, sort, and distribute materials to individual work areas. Store materials in an organized manner as not to obstruct other trades and the normal day-to-day operation of this project.

1. Coordinate storage areas with the Construction Manager.
2. Schedule deliveries to minimize onsite storage and coordinate with all trades.
3. Provide flagmen for operation in contact with public traffic for deliveries.
4. Moving material that is obstructing another contractor's scope is at the cost of the contractor storing the material.

B. Hoisting: Provide hoisting equipment, labor, means and operations to complete your Work Scope.

C. Scaffolding: Each Work Scope is responsible for your own working platforms, scaffolding, and equipment necessary to access Work. Coordinate scope and timing with all trades.

D. Protection of Adjacent Work: Each subcontractor shall provide necessary protection of roof, flooring and adjacent surfaces during the production of this work.

1. Interior scaffolding and carts must be utilized with rubber, locking wheels.

1.09 WORK RESTRICTIONS

A. Contractor's Field Offices: As directed by the Construction Manager and Owner and outlined in Section 01 50 00, Temporary Facilities and Controls.

B. Construction Staging Area: As directed by the Construction Manager and Owner.

C. Construction Parking: As directed by the Construction Manager and Owner.

D. Egress and Access Routes: Do not obstruct existing access and egress from adjacent Site areas or portions of existing facilities which remain operational throughout Construction Period.

1. Move stored products that interfere with operations of Owner.
2. Obtain and pay for use of additional storage or work areas needed for operations.
3. Keep a path for emergency services to access remaining operational facilities and the site.
4. Do not store materials on existing roof areas.

E. Limit activities to Construction Limits: Notify the Construction Manager if Work activities require work outside Construction Limits. Contactor will coordinate activities with the Construction Manager.
F. Work in Occupied Areas: Work in occupied areas of the facility must be coordinated with the Construction Manager and Owner.
G. Hot Work Permits: Work activities using and causing sparks and open flame must be coordinated with the Construction Manager and the Owner and special procedures shall be complied with as directed by the Construction Manager and Owner.
H. Working Hours: Conduct Work during normal working hours unless expressly agreed to by the Construction Manager and the Owner Representative.

Construction Times (Subject to Revision): It is understood that the project construction schedule will meet the following Owner schedules (i.e work can proceed during the following periods with prior approval by the District). Work may not negatively affect occupied spaces during school hours. Saturday work schedules are permitted with prior scheduling and approval with possible extra charges from the Owner. Sunday and Holiday times must be scheduled with the Owner by permission and will involve overtime charges for the Owner staff.

Summer Schedule: June 22nd through August 18th
Weekdays: Monday – Friday 7:00 a.m. – 7:00 p.m.

Project work hours permitted during School Year
Weekdays Monday – Friday 7:00 a.m. – 7:00 p.m.

Material deliveries are not permitted between 8:30am-9:30am, or 3:30pm-4:30pm during the school year. During the summer schedule deliveries are allowed during work hours only.

Material Deliveries are permitted only during project work hours as described above unless coordinated with and approved by the Construction Manager.

I. System shutdowns will be permitted during non-student periods only, and only with Owner approval and favorable weather conditions pertinent to the system.
J. Tobacco and Vape Free Site: Project Site is a “tobacco free” zone; there is absolutely no smoking, vaping, or use of tobacco products of any kind. Tobacco products are prohibited on the Owner’s Property as required by State Law.
K. Noise Restrictions: Maintain a level of conduct and decorum consistent with the environment in which the Work is being performed.

END OF SECTION 01 12 00

SECTION 01 22 00 – UNIT PRICES AND MATERIAL ALLOWANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for unit prices and allowances.

1. In the space indicated on the Bid Form, submit unit prices as required by this section and listed in the Unit Price Schedule. Only one value for each unit price will be allowed.
2. A unit price is a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the quantities of Work required by the Contract Documents are increased, decreased, or exceeds the allowance.
3. Unit prices include all but not limited to necessary delivery, materials, labor, overhead, profit, insurance and applicable taxes.
4. Refer to individual Specification Sections for construction activities requiring the establishment of unit prices.

B. While unit prices are not to be used in the selection of the successful Bidder, they must be submitted and approved prior to execution of the Contract.

1. The Owner reserves the right to reject a unit price they deem unsatisfactory and to require a resubmittal.
2. The Owner reserves the right to reject the Contractor's measurement of quantities, and to have this Work measured by an independent surveyor or third party before accepting contract amount.

C. The Owner reserves the right to reject any bid that does not include a unit price or assign a unit price based on other bidders' unit prices.

D. Prior to utilizing any allowances, the Contractor will review the proposed utilization with the Construction Manager. If the utilization is approved of in writing, then the Contractor must coordinate all work for which it plans to utilize the allowance with the Construction Manager to ensure that the Construction Manager can observe and confirm the quantities utilized. Allowances include cost of all labor, equipment, material, receiving, handling, and installation as well as Contractor overhead and profit.

E. Certain materials and equipment including installation are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order. Allowances are considered part of the base bid contract and are in addition to amounts otherwise specified or stated in the Contract Documents or that are otherwise reasonably necessary to complete the Work.

F. Upon Substantial Completion, or earlier if it becomes clear than an allowance will not be utilized, the Contractor will execute a Change Order reducing the Contract Sum by the unused quantity allowance, multiplied by the applicable Unit Price.

G. NO CASH allowances for any purpose are included in the Project.

PART 2 - PRODUCTS – (Not Applicable).

PART 3 - EXECUTION – SCHEDULE OF QUANTITY / MATERIAL ALLOWANCES

3.01 WORK SCOPE 1: GENERAL CONTRACTOR/SITE WORK – SCHEDULE OF UNIT PRICES AND CORRESPONDING QUANTITY ALLOWANCES

A. Unit Price No. WS-1A: Rock Removal, Replace with 2A stone

1. Description: Provide Unit Price per CY to remove rock as defined by the Contract Specifications, geotechnical report, and verified by the 3rd party inspector at locations directed by Construction Manager or Architect. Unit price includes legal disposal off-site.
2. Unit of Measurement: **Per Cubic Yard**
3. Quantity Allowances: **Two Hundred (200) CY**

B. Unit Price No. WS-1B: Excavate & Export Unsuitable Soils and Replace with suitable soil

1. Description: Provide Unit Price per CY to excavate, export, legally dispose of, and replace unsuitable soils with 2A modified fill as directed by Construction Manager or Architect.
2. Unit of Measurement: **Per Cubic Yard**
3. Quantity Allowances: **One Hundred (100) CY**

C. Unit Price No. WS-1C: Removal and Disposal of waste liquids, sludge, and other wastes

1. Description: Provide a Unit Price per GAL of liquids that has been deemed unsuitable for soil contamination reasons, after testing by the Owner's representative, and legal disposal of that material under the guidance of PADEP.
2. Unit of Measurement: **Gallon**
3. Quantity Allowances: **Five Hundred (500) GAL**

D. Unit Price No. WS-1D: Provide Additional 8" water main

1. Description: Provide Unit Price per LF to furnish and install additional 8" water main pipe in accordance with the project specifications.
2. Unit of Measurement: **Linear Foot**
3. Quantity Allowances: **Fifty (50) LF**

E. Unit Price No. WS-1E: Provide Additional 6" water main

1. Description: Provide Unit Price per LF to furnish and install additional 6" water main pipe in accordance with the project specifications.
2. Unit of Measurement: **Linear Foot**
3. Quantity Allowances: **Fifty (50) LF**

F. Unit Price No. WS-1F: Provide Additional water main bends/fittings

1. Description: Provide Unit Price per EA to furnish and install additional water main pipe bends/fittings in accordance with the project specifications.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Nine (9) EA**

G. Unit Price No. WS-1G: Provide Additional 8" Sanitary main

1. Description: Provide Unit Price per LF to furnish and install additional 8" sanitary main pipe in accordance with the project specifications.
2. Unit of Measurement: **Linear Foot**
3. Quantity Allowances: **Seventy-Five (75) LF**

H. Unit Price No. WS-1H: Provide Additional Concrete Curb

1. Description: Provide Unit Price per LF to excavate, form, and install new concrete curb and associated asphalt repair at locations directed by Construction Manager or Architect.
2. Unit of Measurement: **Linear Foot**
3. Quantity Allowances: **Two Hundred Fifty (250) LF**

I. Unit Price No. WS-1I: Provide Additional Exterior Concrete Sidewalk

1. Description: Provide Unit Price per SF to excavate, form, and install new concrete sidewalk in accordance with the project specifications at locations directed by Construction Manager or Architect.
2. Unit of Measurement: **Square Foot**
3. Quantity Allowances: **Seven Hundred Fifty (750) SF**

J. Unit Price No. WS-1J: Provide Exploratory Test Pits

1. Description: Provide Unit Price per EA to provide exploratory test pits for utilities along with associated asphalt repair.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Fifteen (15) EA**

K. Unit Price No. WS-1K: Provide Additional Heavy Duty Asphalt Paving

1. Description: Provide Unit Price per SY to furnish and install full depth heavy-duty bituminous asphalt paving as described in the project specifications.
2. Unit of Measurement: **Square Yard**
3. Quantity Allowances: **Three Hundred (300) SY**

L. Unit Price No. WS-1L: Provide Additional Stone Base and Binder Course Existing Paving Repair

1. Description: Provide Unit Price per SY to furnish and install stone base and binder course repairing existing paving where cuts had to be made in accordance with typical sections on the contract documents.
2. Unit of Measurement: **Square Yard**
3. Quantity Allowances: **Seven Hundred Fifty (750) SY**

M. Unit Price No. WS-1M: Provide Utility Trenching and Asphalt Repairs

1. Description: Provide Unit Price per SY to trench and asphalt repairs including 4" PVC piping, 2" screening bed, backfill with 2A modified stone and overlay paving.
2. Unit of Measurement: **Linear Foot**
3. Quantity Allowances: **Three Hundred (300) LF**

N. Unit Price No. WS-1N: Provide Additional Roof Drains

1. Description: Provide Unit Price per EA to furnish and install additional roof and overflow drains as described in the project specifications.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Five (5) EA**

O. Unit Price No. WS-1O: Provide Additional Acoustic Ceiling Tile and Grid

1. Description: Provide Unit Price per SF to furnish and install additional ceiling tile as described in the project specifications as directed by the Construction Manager or Architect.
2. Unit of Measurement: **Square Foot**
3. Quantity Allowances: **Five Hundred (500) SF**

P. Unit Price No. WS-1P: Provide Additional Prep and Painting on Drywall

1. Description: Provide Unit Price per SF to prep and paint additional gyp board as described in the project specifications as directed by the Construction Manager or Architect.
2. Unit of Measurement: **Square Foot**
3. Quantity Allowances: **One Thousand (1000) SF**

Q. Unit Price No. WS-1Q: Remove and Replace Ceramic Tile

1. Description: Provide Unit Price per SF to remove and replace damaged ceramic wall tile in accordance with the project specifications as directed by the Construction Manager or Architect.
2. Unit of Measurement: **Square Foot**
3. Quantity Allowances: **Five Hundred (500) SF**

R. Unit Price No. WS-1R: Remove and Replace VCT Flooring

1. Description: Provide Unit Price per SF to remove and replace damaged VCT flooring in accordance with the project specifications as directed by the Construction Manager or Architect.
2. Unit of Measurement: **Square Foot**
3. Quantity Allowances: **Five Hundred (500) SF**

S. Unit Price No. WS-1S: Remove and Replace 5/8" GWB

1. Description: Provide Unit Price per SF to remove and replace damaged 5/8" GWB in accordance with the project specifications as directed by the Construction Manager or Architect.
2. Unit of Measurement: **Square Foot**
3. Quantity Allowances: **One Thousand (1000) SF**

T. Unit Price No. WS-1T: Remove and Replace Exterior Face Brick Masonry

1. Description: Provide Unit Price per SF to remove and replace damaged exterior face brick masonry in accordance with the project specifications as directed by the Construction Manager or Architect.
2. Unit of Measurement: **Square Foot**
3. Quantity Allowances: **Five Hundred (500) SF**

U. Unit Price No. WS-1U: General Laborer Hours

1. Description: Provide Unit Price per Hour for a fully burdened general laborer for the Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per Hour**
3. Quantity Allowances: **One-Hundred Sixty (160) Hours**

V. Unit Price No. WS-1V: Journeyman Mason Hours

1. Description: Provide Unit Price per Hour for a fully burdened journeyman mason for the Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per Hour**
3. Quantity Allowances: One-Hundred Sixty (160) Hours

W. Unit Price No. WS-1W: Journeyman Cement Finisher Hours

1. Description: Provide Unit Price per Hour for a fully burdened journeyman cement finisher for the Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per Hour**
3. Quantity Allowances: **One-Hundred Sixty (160) Hours**

X. Unit Price No. WS-1X: Journeyman Roofer Hours

1. Description: Provide Unit Price per Hour for a fully burdened journeyman roofer for the Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per Hour**
3. Quantity Allowances: **One-Hundred Sixty (160) Hours**

Y. Unit Price No. WS-1Y: Overtime General Laborer Hours

1. Description: Provide Unit Price per Hour for a fully burdened general laborer for the Owner's use for work during overtime hours as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per Hour**
3. Quantity Allowances: **One-Hundred Sixty (160) Hours**

Z. Unit Price No. WS-1Z: Soft Dig Excavation

1. Description: Employ a soft dig vacuum truck in lieu of conventional excavation for utility work where agreed by the owner and CM per week of use.
2. Unit of Measurement: **Week**
3. Quantity Allowances: **Two (2) Weeks**

3.02 WORK SCOPE 2: ELECTRICAL – SCHEDULE OF UNIT PRICES AND CORRESPONDING QUANTITY ALLOWANCES

A. Unit Price No. WS-2A: Provide New 4" Conduit

1. Description: Provide and install additional 4" conduit in accordance with the project specifications.
2. Unit of Measurement: **Linear Foot**
3. Quantity Allowances: **Three Hundred Fifty (350) LF**

B. Unit Price No. WS-2B: Provide 60 AMP, 3-pole Switch Assembly

1. Description: Provide and install 60 AMP, 3 pole electrical fused switch assembly in accordance with the project specifications.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Three (3) EA**

C. Unit Price No. WS-2C: Provide 100 AMP, 3-pole Switch Assembly

1. Description: Provide and install 100 AMP, 3 pole electrical fused switch assembly in accordance with the project specifications.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Three (3) EA**

D. Unit Price No. WS-2D: Duplex Receptacle & Wiring

1. Description: Provide additional duplex receptacle and 20A circuit, including 20A/1P circuit breaker, backbox, faceplate, and 100’ one-way circuit distance.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Five (5) EA**

E. Unit Price No. WS-2E: Data Outlets

1. Description: Provide additional computer data outlet in masonry or stud wall that includes up to 100' of armored plenum cable and all termination and accessories as specified in the project drawings and specifications.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Five (5) EA**

F. Unit Price No. WS-2F: Exit Device and Wiring

1. Description: Provide additional exit sign type ‘X’ including mounting equipment, up to 100’ of wiring with appropriate terminations and connections. Perform in accordance with applicable Specifications and Drawing requirements for similar work.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Five (5) EA**

G. Unit Price No. WS-2G: Fire Alarm Smoke Detector Device and Wiring

1. Description: Provide additional mounted fire alarm smoke detector device assembly that includes backbox, cabling, conduit, terminations, connections to fire alarm system, required programming, and 100’ of wiring. Perform in accordance with applicable Specifications and Drawing requirements for similar work.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Ten (10) EA**

H. Unit Price No. WS-2H: Fire Alarm Audio/Visual Device and Wiring

1. Description: Provide additional mounted audio/visual fire alarm device assembly that includes backbox, cabling, conduit, terminations, connections to fire alarm system, required programming, and 100’ of wiring. Perform in accordance with applicable Specifications and Drawing requirements for similar work.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Five (5) EA**

I. Unit Price No. WS-2I: Fire Alarm Pull Station Device and Wiring

1. Description: Provide additional mounted fire alarm pull station device assembly that includes backbox, cabling, conduit, terminations, connections to fire alarm system, required programming, and 100' of wiring. Perform in accordance with applicable Specifications and Drawing requirements for similar work.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Five (5) EA**

J. Unit Price No. WS-2J: Wireless Access Point Cabling

1. Description: Provide a Unit Price per assembly to furnish and install an additional Install 300' of wireless access point cabling plus two data drops per access point in accordance with the applicable Division 27 Sections and Drawing requirements for similar work.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Five (5) EA**

K. Unit Price No. WS-2K: Light Fixture A1

1. Description: Provide a Unit Price per assembly to furnish and install an additional video surveillance camera location consisting of backbox/junction box, mounting equipment, (2) data drops, and 200' of cabling, conduit and all terminations per drop and connections and programming to the video surveillance system. Perform in accordance with applicable Division 27 Sections and Drawing requirements for similar work.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Five (5) EA**

L. Unit Price No. WS-2L: Journeyman Electrician Labor

1. Description: Provide Unit Price per Hour for a fully burdened journeyman electrician labor for Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per Man-hour**
3. Quantity Allowances: **Include 200 manhours**

M. Unit Price No. WS-2M: Journeyman Electrician Labor Overtime Rate

1. Description: Provide Unit Price per Hour for a fully burdened journeyman electrician labor at the overtime rate for Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per Man-hour**
3. Quantity Allowances: **Include 100 manhours**

3.03 WORK SCOPE 3: MECHANICAL – SCHEDULE OF UNIT PRICES AND CORRESPONDING QUANTITY ALLOWANCES

A. Unit Price No. WS-3A: Additional Ductwork

1. Description: Provide insulated galvanized steel ductwork including hangers and accessories in accordance with the applicable Division 23 sections.
2. Unit of Measurement: **Per Pound**
3. Quantity Allowances: **One Thousand (1000) Lbs**

B. Unit Price No. WS-3B: Additional temperature/humidity device, include mounting of device, up to 100' of wiring with appropriate terminations, connections, and programming

1. Description: Provide Unit Price per Assembly to furnish and install an additional temperature/humidity device, include mounting of device, up to 100' of wiring with appropriate terminations, connections, and programming.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Thirty (30) EA**

C. Unit Price No. WS-3C: Provide additional ¾" insulated HVAC Piping

1. Description: Provide Unit Price per LF to furnish and install additional ¾" insulated HVAC piping, accessories and fittings in accordance with the applicable Division 23 sections.
2. Unit of Measurement: **Linear Feet**
3. Quantity Allowances: **Thirty (30) EA**

D. Unit Price No. WS-3D: Provide additional ¾" Isolation Valve

1. Description: Provide Unit Price per Assembly to furnish and install an additional ¾" isolation valve in HVAC piping.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Ten (10) EA**

E. Unit Price No. WS-3E: Provide additional 2" Isolation Valve

1. Description: Provide Unit Price per Assembly to furnish and install an additional 2" isolation valve in HVAC piping.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Ten (10) EA**

F. Unit Price No. WS-3F: Provide additional 6" Isolation Valve

1. Description: Provide Unit Price per Assembly to furnish and install an additional 6" isolation valve in HVAC piping.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Two (2) EA**

G. Unit Price No. WS-3G: Provide Additional Combination Temperature/Humidity Sensors

1. Description: Provide Unit Price per Assembly to furnish and install a combination temperature/humidity sensor.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Thirty (30) EA**

H. Unit Price No. WS-3H: Provide additional 2'x2' Fire Rated Access Door

1. Description: Provide Unit Price per 2'x2' 1 hour rated access panel.
2. Unit of Measurement: **Each**
3. Quantity Allowances: **Ten (10) EA**

I. Unit Price No. WS-3I: Journeyman Pipefitter Labor

1. Description: Provide Unit Price per Hour for a fully burdened journeyman pipefitter worker for Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per man-hour**
3. Quantity Allowances: **Include 100 man hours**

J. Unit Price No. WS-3J: Journeyman Sheetmetal Labor

1. Description: Provide Unit Price per Hour for a fully burdened journeyman Sheetmetal worker for Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per man-hour**
3. Quantity Allowances: **Include 150 man hours**

K. Unit Price No. WS-3K: Journeyman Pipefitter Overtime Labor

1. Description: Provide Unit Price per Hour for a fully burdened journeyman pipefitter worker at the overtime rate for Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per man-hour**
3. Quantity Allowances: **Include 100 man hours**

3.04 WORK SCOPE 4: PLUMBING – SCHEDULE OF UNIT PRICES AND CORRESPONDING QUANTITY ALLOWANCES

A. Unit Price No. WS-4A: Additional 3/4" Domestic Water Piping

1. Description: Provide 3/4" insulated domestic water piping, hangers, accessories and fittings in accordance with the applicable Division 22 sections.
2. Unit of Measurement: **Per Lineal Foot**
3. Quantity Allowances: **Seventy-Five (75) LF**

B. Unit Price No. WS-4B: Additional 1" Domestic Water Piping

1. Description: Provide 1" insulated domestic water piping, hangers, accessories and fittings in accordance with the applicable Division 22 sections.
2. Unit of Measurement: **Per Lineal Foot**
3. Quantity Allowances: **Seventy-Five (75) LF**

C. Unit Price No. WS-4C: Additional 2" Domestic Water Piping

1. Description: Provide 2" insulated domestic water piping, hangers, accessories and fittings in accordance with the applicable Division 22 sections.
2. Unit of Measurement: **Per Lineal Foot**
3. Quantity Allowances: **Seventy-Five (75) LF**

D. Unit Price No. WS-4D: Additional Below Grade PVC Sanitary Piping

1. Description: Provide a Unit Price per Linear Foot to furnish and install additional below grade sanitary piping as detailed in Specifications and Drawings including excavation, connections, bedding, backfill, and compaction.
2. Unit of Measurement: **Per Linear Foot**
3. Quantity Allowances: **Forty (40) LF**

E. Unit Price No. WS-4E: Additional 2" Ball Valve

1. Description: Provide a Unit Price per Assembly to furnish and install 2" ball valve in 1" domestic water piping in accordance with the applicable Division 22 sections.
2. Unit of Measurement: **Per assembly**
3. Quantity Allowances: **Ten (10) EA**

F. Unit Price No. WS-4F: Additional 2" Domestic Water Piping Insulation

1. Description: Provide a unit price per LF to furnish and install 2" insulation in accordance with the applicable Division 22 sections.
2. Unit of Measurement: **Per Lineal Foot**
3. Quantity Allowances: **Thirty (30) LF**

G. Unit Price No. WS-4G: Additional Concealed Sprinkler Head

1. Description: Provide a Unit Price per Assembly to furnish and install new concealed sprinkler head in finished ceiling areas in accordance with the applicable Division 21 sections.
2. Unit of Measurement: **Per assembly**
3. Quantity Allowances: **Twenty (20) EA**

H. Unit Price No. WS-4H: Journeyman Plumber Labor

1. Description: Provide Unit Price per Hour for a fully burdened journeyman Plumber for Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per Man hour**
3. Quantity Allowances: **Include 80 man-hours**

I. Unit Price No. WS-4I: Journeyman Plumber Labor Overtime Rate

1. Description: Provide Unit Price per Hour for a fully burdened journeyman Plumber at an overtime rate for Owner's use for work as directed by the Construction Manager and at his discretion.
2. Unit of Measurement: **Per Man hour**
3. Quantity Allowances: **Include 80 man-hours**

END OF SECTION 01 22 00

SECTION 01 23 00 – ALTERNATES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section describes the limits of the requested alternates to the Contract work. Refer to the Product/Execution Articles of the appropriate Specifications and the Drawings for information pertaining to the work of each alternate.
B. Each proposal under an alternate shall include all incidental work and all adjustments necessary to accommodate the changes. All work shall meet the requirements of the Drawings, Specifications and appropriate details.
C. Submit each alternate proposal as an individual cost for the particular alternate. The alternate shall be proposed under the premise that no other alternates have been accepted. Should the work of an alternate called for by the Bid Form not affect the cost of the work, state "No Change" in the space provided. If an alternate is left blank, the Owner reserves the right to throw out the entire bid or interpret the alternate as "No Change".
D. Include taxes which are applicable to work involved in alternates as well as costs, if any, for increased coverage of bonds and insurance.
E. Any of the alternates may be accepted by Owner and will be used in determining the low bidder.
F. Owner may, at their option, vary the scope of the work by authorizing alternates which will add to the work, deduct from the work or substitute materials, equipment or methods.
G. Each Bidder shall examine the Drawings and Specifications to determine the extent to which their work is affected by bid alternates. Include in the space provided on the bid form the cost of any added or deducted work resulting from each alternate.
H. Contractor is responsible for providing work if applicable to each alternate, whether or not an added or deducted cost is included on their bid form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 IMPLEMENTATION

A. If the Owner elects to proceed on the basis of one or more of the alternates, make all modifications to the Work required in the furnishing and installation of the selected alternate or alternates subject to the approval of the Architect at no additional cost to the Owner except as proposed in the Bid.
B. Coordinate pertinent related work and modify surrounding work as required to properly integrate the work under each alternate, and to provide the complete construction required by Contract Documents.
C. If so stated in the Agreement, or modifications thereto, provide alternate materials, equipment and/or construction as specified.
D. 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.

3.02 SCHEDULE OF ALTERNATES

A. Work Scope No. 1:

1. Alternate No. 1: Reduced Gym Size.

a. Base Bid: Gymnasium documented to size/layout in A1 – A8 series of drawings.
b. Alternate Bid: Gymnasium documented to size/layout in A9 series of drawings.
c. Scope: Storage and office are to the west of the gym with a 76’ court length in the base bid. Storage and office are to the south of the gym with a 68’ court length in the alternate bid.
d. Reference: A1.01-C and associated RCPs, finish plans, and details. A9.00 series for alternate.

2. Alternate No. 2: Reduction of Main Entry Canopy

a. Base Bid: Construct canopy in its’ entirety.
b. Alternate Bid: Construct reduced canopy size shown on A1.40. Reduce structural columns and downspouts associated with larger canopy only.
c. Reference: Drawing A1.40.

3. Alternate No. 3A: Install quartz tile in lieu of terrazzo throughout first and second floors.

a. Base Bid: Terrazzo where indicated
b. Alternate Bid: Quartz tile where terrazzo is indicated.
c. Reference: Design Selection Summary and finish plans.

4. Alternate No. 3B: Install quartz tile in lieu of terrazzo throughout the second floor only.
    a. Base Bid: Terrazzo where indicated
    b. Alternate Bid: Quartz tile where terrazzo is indicated on the second floor.
    c. Reference: Design Selection Summary and finish plans.

5. Alternate No. 3C: Install SVT in lieu of terrazzo throughout the second floor.
    a. Base Bid: Terrazzo where indicated
    b. Alternate Bid: SVT where terrazzo is indicated on the second floor.
    c. Reference: Design Selection Summary and finish plans.

6. Alternate No. 4: Remove upper cabinets in the classrooms where indicated.
    a. Base Bid: Provide all documented casework.
    b. Alternate Bid: Remove upper cabinets where indicated and provide finished wall construction to match surrounding finish.
    c. Reference: Interior elevations.

7. Alternate No. 5: Remove tack panels above marker board in classrooms where indicated.
    a. Base Bid: Provide all documented tack panels.
    b. Alternate Bid: Remove tack panels where indicated in classrooms and replace with tack strips.
    c. Reference: Interior elevations.

8. Alternate No. 6A: Add both sets of bleachers in gymnasium (base bid layout).
    a. Base Bid: No bleachers are provided in base bid.
    b. Alternate Bid: Add both sets of bleachers where indicated in drawing A1.01-C.
    c. Reference: Drawing A1.01-C..

9. Alternate No. 6B: Add 1 set of bleachers in gymnasium (base bid layout, southern bleacher).
    a. Base Bid: No bleachers are provided in base bid.
    b. Alternate Bid: Add 1 set of the bleachers indicated in drawing A1.01-C.
    c. Reference: Drawing A1.01-C..

10. Alternate No. 6C: Add both sets of bleachers in gymnasium (alternate layout).
    a. Base Bid: This alternate only applies if Alternate #1 is selected.
    b. Alternate Bid: Add bleachers where indicated in drawing A9.01.
    c. Reference: Drawing A9.01.

11. Alternate No. 6D: Add 1 set of bleachers in gymnasium (alternate layout, southern bleacher).
    a. Base Bid: This alternate only applies if Alternate #1 is selected.
    b. Alternate Bid: Add 1 set of the bleachers where indicated in drawing A9.01.
    c. Reference: Drawing A9.01.

12. Alternate No. 7: Mechanical Courtyard.
    a. Base Bid: Provide all site walls, gates, and concrete pad associated to mechanical courtyard as indicated in Area D.
    b. Alternate Bid: Remove all site walls, gates, and concrete pad associated to mechanical courtyard as indicated in Area D.
    c. Reference: Drawing A1.01-D.

13. Alternate No. 8: ADD – Unclassified Rock Excavation.
    a. Base Bid: Classified excavation. Contractor is to provide Unit Prices for excavation and include quantities of Unit Prices in the Allowance as part of the base bid. The cost for rock excavation will be paid by change order out of the Allowance.
    b. Alternate Bid: Unclassified excavation. Contractor is responsible for all excavation cost as part of the Contract. The quantities for Unit Price WS-1A are to be reduced to zero (0) and no rock removal unit price will be paid by owner.

14. Alternate No. 9: ADD – Provide engineered structural fill or 2A modified stone 24” deep in lieu of onsite materials for all building pad fills.
    a. Base Bid: Utilize the onsite materials for fill needed at the building pad.
    b. Alternate Bid: Provide engineered structural fill or 2A Modified stone (24" deep) in lieu of using onsite materials for all fills required below the bottom of slab subgrade stone for the entire new building pad and up to 5' outside the new building's exterior wall line. Under this Alternate, the resulting excess site soils are to be disposed of legally off-stie by the contractor.

15. Alternate No. 10: ADD – Provide sod up to 5’ outside of the building footprint.
    a. Base Bid: seed all areas as indicated in the construction drawings.
    b. Alternate Bid: Provide 5’ of sod around the perimeter of the building footprint where grass is indicated in the construction drawings.

16. Alternate No. 11: ADD – Replace the base bid mechanical system with a Geothermal well mechanical system as indicated in the project drawings.
    a. Base Bid: Sitework, trenching, and piping as indicated on the contract documents
    b. Alternate Bid: Sitework, trenching and piping as indicated on contract document C7.01

B. Work Scope No. 2:

1. Alternate No. 1: Reduced Gym Size.
    a. Base Bid: Gymnasium documented in drawings.
    b. Alternate Bid: Gymnasium alternate documented to size/layout in E6-E9 series of drawings. Scope: Storage and office are to the west of the gym with a 76’ court length in the base bid as shown on the draings. Storage and office are to the south of the gym with a 68’ court length in the alternate bid as shown on the drawings.

2. Alternate No. 2: ADD – Replace the base bid mechanical system with a Geothermal well mechanical system as indicated in the project drawings.
    a. Base Bid: Mechanical systems and power as indicated on contract document E6.0
    b. Alternate Bid: Mechanical systems and power as indicated on contract document E6.1

C. Work Scope No. 3:

1. Alternate No. 1: Reduced Gym Size.
    a. Base Bid: Gymnasium documented in drawings.
    b. Alternate Bid: Gymnasium alternate documented to size/layout in M1.01-C of drawings. Scope: Storage and office are to the west of the gym with a 76’ court length in the base bid as shown on the drawings. Storage and office are to the south of the gym with a 68’ court length in the alternate bid as shown on the drawings.

2. Alternate No. 2: ADD – Replace the base bid mechanical system with a Geothermal well mechanical system as indicated in the project drawings.
    a. Base Bid: Mechanical systems and piping as indicated on contract documents as base bid
    b. Alternate Bid: Mechanical systems and piping as indicated on contract documents as alternate

3. Alternate No. 3: Allow for HDPE, PVC, or CPVC in lieu of Copper/Steel
    a. Base Bid: Copper and steel piping as indicated in the contract drawings and specifications
    b. Alternate Bid: HDPE, PVC, or CPVC in lieu of copper/steel as indicated in the contract drawings and specifications

D. Work Scope No. 4:

1. Alternate No. 1: Reduced Gym Size.
    a. Base Bid: Gymnasium documented in drawings.
    b. Alternate Bid: Gymnasium alternate documented to size/layout in P1.01c of drawings. Scope: Storage and office are to the west of the gym with a 76’ court length in the base bid as shown on the drawings. Storage and office are to the south of the gym with a 68’ court length in the alternate bid as shown on the drawings.

2. Alternate No. 2: ADD – Replace the base bid mechanical system with a Geothermal well mechanical system as indicated in the project drawings.
    a. Base Bid: Piping as indicated on contract documents as base bid
    b. Alternate Bid: Piping as indicated on contract documents P2.01d as alternate

3. Alternate No. 3: Allow for HDPE, PVC, or CPVC in lieu of Copper/Steel
    a. Base Bid: Copper and steel piping as indicated in the contract drawings and specifications
    b. Alternate Bid: HDPE, PVC, or CPVC in lieu of copper/steel as indicated in the contract drawings and specifications

END OF SECTION 01 23 00

SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications. Changes in the Project scope of work affecting the project will be made through Procore.
B. See General Conditions of the Work for methods of determining cost or credit, mark-up and schedule for submitting claims.

1.03 MINOR CHANGES IN THE WORK

A. Construction Manager or Architect will issue Supplemental Instructions (SI) which are used to authorize minor changes in the Work not involving adjustment to Contract Sum or time.
B. This no cost change is to be carried out in accordance with the modifications to the Contract Documents described therein. If this change effects cost, do not proceed with this change. Notify the Construction Manager in writing within 10 days of receipt that an itemized quotation (per the requirements listed in 1.04) will be submitted within 21 days of initial receipt of this Supplemental Instruction. If a cost is not submitted within 21 days, this Supplemental Instruction will be accepted at no additional cost.

1.04 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Construction Manager will issue 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. Proposal Requests issued by Construction Manager are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within 10 days of receipt of Proposal Request, Contractor submit an itemized 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 contractor’s overhead and profit broken out.
e. 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.
f. If a cost is not submitted within 10 days, this Proposal Request can be accepted at no additional cost. Written approval is required prior to proceeding with this change.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Construction Manager.

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 contractor’s overhead and profit broken out.
6. 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.
7. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: For Change Order Proposals, use forms provided by the Construction Manager.

1.05 CHANGE ORDER PROCEDURES

A. The Construction Manager will review the Contractor’s labor and material itemized quotation and respond in writing whether it is acceptable, or needs revision. When all pricing is accepted by the Construction Manager and Owner, a Change Order will be processed. Change Orders will be processed at intervals determined by the Construction Manager throughout the construction schedule.

1.06 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive (CCD): The Construction Manager may issue a Construction Change Directive to instruct the Contractor to proceed with a change in the Work for subsequent inclusion in a Change Order. The CCD contains a complete description of the change in the Work and designates a method to be followed to determine change in the Contract Sum or time.

1. Proceed immediately to carry out changes as directed in the issued CCD in the Contract Documents as described therein.
2. Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
3. 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 01 26 00

SECTION 01 29 00 – PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment. ICS utilizes Procore for the invoicing process.

B. Related Sections include the following:

1. Division 01 Section 01 22 00 "Unit Prices and Material Allowances" for administrative requirements governing the use of unit prices.
2. Division 01 Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Division 01 Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.03 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating the entire Contract Sum among the various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule. The Schedule of Values are to provided by the Contractor for entry into Procore.

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. Provide the Schedule of Values information within template provided by the

Construction Manager at the earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

3. Sub-schedules: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

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 two line items (labor and material) for each Specification Section. If invoicing for shop drawings break that amount into a separate line item. Construction Manager will enter the Schedule of Value within the “Commitments” section of Procore for use with the Project.

1. 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.
2. Round amounts to nearest whole dollar, total shall equal the Contract Sum.
3. 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.
4. 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. Differentiate between items stored on site and items stored off site.
5. 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.
6. 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.
7. Temporary facilities and other major cost items that are not direct costs 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.
8. Schedule of Values Updating: Update and resubmit the Schedule of Values before the next Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
9. Project Schedule Updating: Update and resubmit the Project Milestone Schedule with each Application for Payment when approved schedule changes result in a change to the overall schedule.

1.05 APPLICATIONS FOR PAYMENT

A. Procore’s “Invoicing” tool to be utilized.

1. CM will issue an Invitation to Bill monthly.
2. Under the “Do you want to bill this period,” area, choose the following:

   a. If you want to submit the invoice, click Yes. Then click Post Response and

continue with step 3. OR

b. If you are not ready to submit the invoice, click No. Then click Post Response.

3. At the Create New Invoice page in Procore, the Period Start, Period End and Billing Date is pre-filled with what the CPM set. Enter the invoice number.
4. In the Detail section, enter either your percent complete or amount complete for each line item in your original Schedule of Values
5. Enter the materials presently stored amount. This will be added to the percent complete for each line item. Reference Stored Material requirements detailed in Article 9.3.2 of Section 00 72 00, General Conditions.
6. In the Approved Commitment Change Orders section, repeat the process for each change order's line items by entering the percent or amount complete for each line item. Any new approved change orders will automatically be added at this location.
7. Pencil copies shall be submitted through Procore's "Invoicing" tool for Construction Manager and/or Construction Manager review, no later than the 15th of each month forecast for work performed to the end of the month in accordance with Article 9.3.1 of Section 00 72 00, General Conditions.
8. Once pencil copies are approved, attach required backup documentation; at a minimum, a signed, notarized copy of the application. Contact the CPM to determine if additional documentation is required.

    a. How to export the Pay Application in Procore:

        1) Click Save
        2) Click Export and select PDF
        3) Sign the PDF
        4) Return to Procore and select the Summary Tab
        5) Click Edit
        6) Attach the signed PDF's

B. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect, Construction Manager 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.

C. Payment Application Times: The date for submission of each application for payment is the 25th day of each month. The period covered by each Application for Payment ends on the FINAL 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. No faxed, emailed or mailed, Applications for Payment will be accepted. The period of Construction Work covered by each Application for Payment is the period indicated in the Agreement.

D. Accuracy – All Payment Applications must accurately reflect work completed through the end of the month. Any Payment Application deemed inaccurate by the Construction Manager will be rejected in its entirety.

E. Monthly payments will be made per Section 5.1 of the A132-2019. Retainage will be held in accordance with Article 9.3.4 of Section 00 72 00, General Conditions. Payment

will be made for material stored on the project site, and material stored off the project site with prior agreement.

F. Payment Application Forms: Procore's preset AIA form to be utilized.

G. Application Preparation: Complete every entry in Procore. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager 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 for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

H. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on site and items stored off site. Reference Article 9.3.2 of Section 00 72 00, General Conditions, for complete requirements of Stored Materials.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:
4. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
5. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
6. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's 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 reports.
12. Report of pre-construction conferences.

13. Initial settlement survey and damage report if required.

J. The first payment application will not be processed unless these, and any other items required by the Construction Manager or Architect, are processed.

K. A separate Application(s) for Payment shall be submitted for when reduction in retainage is requested shall be submitted along with AIA Document G707A-1994, "Consent of Surety to Reduction or Partial Release of Retainage" and surety's executed appropriate Power of Attorney.

L. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.

1. This Application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

2. Administrative actions and submittals that shall precede this Application include:

a. Occupancy permits and similar approvals.
b. Warranties (guarantees) and maintenance agreements.
c. Test/adjust/balance records.
d. Maintenance instructions.
e. Meter readings.
f. Startup performance reports.
g. Changeover information related to Owner's occupancy, use, operation and maintenance.
h. Final clean
i. Application for reduction of retainage and consent of surety to reduction of retainage.
j. List of incomplete Work, recognized as exceptions to Construction Manager's Certificate of Substantial Completion.
k. Provide Operation and Maintenance (O+M) materials or supplies listed in all pertaining Specification Sections.

M. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted. Administrative actions and submittals that must precede the final Application for Payment include the following:

1. Evidence of completion of Project closeout requirement.
2. Certification of completion of final punch list items.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707-1994, "Consent of Surety to Final Payment."
7. Completion of items specified for completion after Substantial Completion
8. Evidence that claims have been settled.
9. Ensure that incomplete Work will be completed without undue delay.
10. Transmittal of required Project construction records to the Construction Manager, including As-Builts, warranty, O+M's.
11. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.

12. Removal of temporary facilities and services.
13. Removal of surplus materials, rubbish, and similar elements.
14. Final, liquidated damages settlement statement.
15. Any other waivers and releases as required.

Part 2 - PRODUCTS (Not Used)

Part 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 29 01 – PAYMENT PROCEDURES FOR ASPHALT PAVING

PART 1 - GENERAL

1.01 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 32 12 16 “Asphalt Paving”.

1.02 ASPHALT PAVING PRICING

A. The Base Bid contract sum shall be adjusted for asphalt paving based upon changes from the Pennsylvania Asphalt Paving Association (PAVA) 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 School District 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 Bitumen 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 Bitumen in Mixture placed

B. Contractor shall submit daily weight tickets to Construction Manager and shall submit plant material certificates identifying Bitumen in mixture placed.

C. Contractor shall submit monthly calculation to Construction Manager based on above formula for verification and final approval by Construction Manager.
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 Construction Manager and Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 01

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Submittals.
3. Administrative and supervisory personnel.
4. Project meetings.
5. Web Based Project Management System (Procore)

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 01 12 00 "Multiple Work Scope Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
2. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
3. Division 01 Section 01 31 17, “Coordination Drawings” for procedures and requirements of the coordination of installation of products and materials provided by separate primes.
4. Division 01 Section 01 73 00 "Execution" for procedures for coordinating general installation and field engineering services.
5. Division 01 Section 01 77 00 "Closeout Procedures" for coordinating Contract closeout.

1.03 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction 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 accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, 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 activities of other contractors 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. Pre-installation conferences.
7. Temporary Certificate of Occupancy activities.
8. Project closeout activities.

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, the Construction Manager and 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, Architect/Engineer, and Construction Manager.
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.

1.04 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Indicate relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Refer to Division 23 Section "Basic Mechanical Materials and Methods" and Division 26 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for mechanical and electrical installations.

B. Staff Names: Submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site in accordance with procedures outlined in Section 3.9 of Section 00 72 00, General Conditions.

1.05 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

1.06 PROJECT MEETINGS

A. Preconstruction Conference: The Construction Manager will schedule a preconstruction conference before starting construction, at a time convenient to Owner, Architect and Contractor(s) within 15 days after execution of the Agreement. The conference will be held at the Project site or another convenient location. The meeting will review responsibilities and personnel assignments and other pertinent issues to the project.

1. Attendees: Authorized representatives of Owner, Architect and their consultants; Prime Contractor(s) and their superintendent; major subcontractors and other Owner pre-approved parties shall attend the conference. All 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. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing.
    d. Long Leadtime items.
    e. Designation of responsible personnel.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for processing Applications for Payment.
    h. Distribution of the Contract Documents.
    i. Submittal procedures.
    j. Preparation of Record Documents.
    k. Use of the premises.
    l. Responsibility for temporary facilities and controls.
    m. Parking availability.
    n. Office, work, and storage areas.
    o. Equipment deliveries and priorities.
    p. First aid.
    q. Security.
    r. Progress cleaning.
    s. Working hours.
    t. Construction IAQ Management Plan activities.

B. Pre-installation Conferences: Prime Contractors and Construction Manager shall coordinate and conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Construction Manager, 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 the Architect and Owner 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 Change Orders.
    d. Purchases.
    e. Deliveries.
    f. Submittals.
    g. Review of mockups.
    h. Possible conflicts.
    i. Compatibility problems.
    j. Time schedules.
    k. Weather limitations.
    l. Manufacturer's written recommendations.
    m. Warranty requirements.
    n. Compatibility of materials.
    o. Acceptability of substrates.
    p. Temporary facilities and controls.
    q. Space and access limitations.
    r. Regulations of authorities having jurisdiction.
    s. Testing and inspecting requirements.
    t. Coordination with other work.
    u. Required performance results.
    v. Protection of construction and personnel.

3. Construction Manager to record significant conference discussions, agreements, and disagreements and issue meeting minutes to the group.
4. 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.

C. Progress Meetings: Attend progress meetings as scheduled or when notified. Meetings will be generally held every other week unless progress or significant issues arise in the progress or lack thereof of the work.

1. Attendees: In addition to representatives of Owner, Architect and CM, 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 conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. 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.
    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Resolution of BIM component conflicts.
        4) Status of submittals.
        5) Deliveries.
        6) Off-site fabrication.
        7) Access.
        8) Site utilization.
        9) Temporary facilities and controls.
        10) Work hours.
        11) Hazards and risks.
        12) Review of open RFI’s.
        13) Progress cleaning.
        14) Quality and work standards.
        15) Change Orders.
        16) Documentation of information for payment requests.
        17) Site security and safety issues.

3. Reporting: The Construction Manager will distribute minutes of the meeting to each party present and to parties who should have been present. Minutes will include a brief summary, in narrative form, of progress since the previous meeting and report.

    a. The Contractor shall revise the 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. Contractor shall provide and include a two- week look ahead schedule.

D. Weekly Superintendent Meetings: Attend weekly superintendent meetings scheduled and chaired by the Construction Manager or General Contractor. Chair to be agreed upon by the Construction Manager..

1. Attendees: In addition to representatives of the Owner and Construction Manager, each contractor and subcontractor responsible for work in the upcoming two weeks to be represented.
2. Agenda: Review the work planned in the next four weeks and other items that may affect work in the short term including:

a. Deliveries.
b. Site traffic patterns.
c. Subcontractors working at the site.
d. Maintenance of erosion and sediment control features.
e. Site cleanliness.
f. Planned work hours.
g. Coordination items.

3. At each coordination meeting, the following shall occur:

   a. GC shall provide a four-week look ahead schedule from the current overall CPM schedule listing the tasks start, finish, and total float for the next two weeks.
   b. Each prime contractor superintendent shall be prepared to address the four-week list of tasks and provide their plan for executing each task as per the schedule.
   c. If any task is not going to be met, contractors shall then provide immediate recovery plan which will be incorporated into the overall schedule update.

4. At each coordination meeting, each Prime Contractor is to provide a written four-week look ahead schedule to the General Contractor and Construction Manager for review and comment.
5. The Construction Manager shall write meeting minutes for each coordination meeting and distribute them to each Prime Contractor and to the Architect for review within two days after the meeting.

1.07 WEB BASED PROJECT MANAGEMENT SYSTEM

A. The web-based Project Management System designated for use with this Project is Procore.

B. Prime Contractors shall use the Procore system to transmit documents, track, and otherwise manage this project. Use of the system will be mandatory by the Prime Contractors to send, retrieve, and respond to data.
C. Use of this project management software will not change any contractual responsibilities of the construction team members.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 31 17 - COORDINATION DRAWINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 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 Documents and Sections: The following documents and Sections contain requirements that relate to this Section:

1. Division 01 Section 01 33 00 “Submittal Procedures”.
2. Division 01 Section 01 31 00 “Project Management and Coordination” and Division 01 Section 01 12 00 “Multiple Work Scope Summary” specify requirements for coordinating construction operations by the Prime Contractors.

1.03 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 any distributed BIM Models shall not be construed as dictating the ways and means of construction.

1.04 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 2026) operating in Microsoft Windows operating system.
2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format and Navisworks File (NWC).
3. Architect and their consultants will furnish Contractor one set of Revit 2026 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 2026 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 Specification Section 01 31 26, Electronic Communication Protocols, 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 200 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.

1.05 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 & BIM layout drawings shall be submitted by HVAC Contractor within 60 calendar days of Contract Award.
D. Final Submittal: Submit final BIM layout drawings & 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 Construction Manager 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 AutoCAD 2018 or later. 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. Construction Manager.
    c. General Contractor.
    d. HVAC Contractor.
    e. Plumbing Contractor/Fire Protection.
    f. Electrical Contractor.

g. Subcontractors as deemed appropriate by the Construction Manager or 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 pipes, conduits, and pipes with a diameter of less than 6 inches with single lines.
   b. Indicate ducts and pipes with a diameter of 6 inches and greater with double lines showing width to scale.
   c. Indicate busways to scale.
   d. Use a competent BIM operator to develop Coordination Drawings in a clear, legible manner.
   e. The Owner, Construction Manager, 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, hangars, and connections.
8. Kitchen Drawings – Show all kitchen equipment and required connections.
9. Other contractors required to participate in coordination drawing program shall indicate their work on the BIM Layout Drawings as directed.
10. 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 Construction Manager or HVAC Contractor.
11. Scheduling: Time allotted for each contractor to develop their Coordination Drawings and schedule of coordination meeting will be determined by the HVAC Contractor and Construction Manager 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.

12. 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 a 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 of changes. HVAC contractors shall pay 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 Construction Manager and 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 price.

    a. Do not change sizes, adjust location of exposed items, or expose items not shown exposed on Contract Drawings without approval of the Construction Manager or 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 and Construction Manager 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 Construction Manager, shall be represented at the meetings to review, and resolve conflicts and interferences.

4. Coordination Sequence:

    a. Each Prime Contractor shall locate, measure, and document on the Coordination Drawings the location of existing system components related to their contract responsibility within the proposed work areas.
    b. The GC will remove the existing ceilings in the areas indicated on the Phasing drawings.
    c. The GC will provide the HVAC contractor with the structural steel detailed drawing to use for coordination in the proposed addition.
    d. 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.
    e. HVAC Contractor to model all HVAC systems. HVAC to perform clash detection between HVAC, electrical, plumbing, structural items, and all other major systems such as ceilings.
    f. HVAC to provide all other prime contractors the coordinated Structural and HVAC models.
    g. All prime contractors to complete their 3D Models for their systems. Upon completion, provide model to HVAC contractor with the proposed new components located.
    h. 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 or conflicts with respective contractors.

5. Coordination Responsibility: **All Prime Contractors have collective responsibility to fulfill coordination requirements**. The HVAC Contractor and Construction Manager 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 Construction Manager. In the event an agreement as to responsibility cannot be reached, the determination by the Construction Manager shall be final and binding.

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 Construction Manager 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 Construction Manager. 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. Included a statement and signature on shop drawings indicating contractor's review and conformance with Coordination Drawings.

1. Architect's or Construction Manager'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, Construction Manager, 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 recording 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 Construction Manager.

1.06 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. Overhead coiling doors
3. Operable Partitions
4. Gymnasium equipment supports
5. HVAC systems
6. Electrical systems
7. Plumbing systems
8. Fire protection systems including sprinklers
9. Opening and sleeves in structural slabs and structural framing
10. Ceiling systems
11. Wall systems
12. Stage equipment

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. Overhead Coiling Doors
3. Operable Partitions
4. Gymnasium equipment supports
5. 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.

6. 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. Panel boards, switch boards, switch gear, transformers, busways, generator, and motor control center.
    f. System racks.
    g. Exit signs, strobe/horn, and emergency battery pack locations.
    h. Pull boxes dimensional from column centerlines.
    i. Cable tray pathways.

7. Electrical Systems: Other

    a. Lighting systems and fixtures.
    b. Power systems, conduit, and cable tray.
    c. Sound and other systems.

8. Plumbing and Fire Protection System:

    a. Sizes and centerline elevations of sprinkler piping.
    b. Sprinkler head locations with elevations reverenced 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 clean out locations.

9. 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, hangars, connections, braces, and other structural systems.

10. 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.
11. Wall Systems: All walls, chases, and other components.
12. Stage Equipment.

1.07 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 – PRODUCTS (Not Used)

END OF SECTION 01 31 17

SECTION 01 31 26 – ELECTRONIC COMMUNICATION PROTOCOLS

PART 1 - GENERAL

1.01 SUMMARY

A. The Architect will provide the Contractor with one (1) electronic copy of the background drawing at their request. Requested files will be provided via email to the Contractor in AutoDesk AutoCAD format.

B. The terms and conditions on the attached form “Attachment A – Alloy5 Electronic File Agreement" apply to all Electronic Documents issued by ICS-CMTA or its consultants for the project. Files will be furnished in their original software format and are not available in any other format. The Architect does not guarantee software/hardware compatibility.

1. Exceptions:
    a. For access to electronic documents by Structural Engineer, Barry Isett & Associates, the Contractor will need to sign an additional Agreement for Electronic File Transfer that can be made available upon request.
    b. For access to electronic documents by Mechanical/ Electrical Engineer, CMTA, Contractor will need to sign an additional Agreement for Electronic File Transfer that can be made available upon request.
    c. For access to electronic documents by other consultants on the project, the Contractor may need to sign an additional Agreement for Electronic File Transfer that can be made available upon request.

C. The documents provided were prepared by Architect or their consultants as instruments of service to the Owner for this Project. The Owner and the Architect do not endorse or warrant the documents as suitable for any other purpose. These documents are furnished without warranties or guarantees (express, implied, or statutory), for the accuracy, reliability, and completeness. These files may vary from the documents used during bidding and do not include modifications issued by addenda or bulletins. If there are conflicts between the electronic drawings and the bid set, the bid set shall govern.

D. In making this request for documents in electronic format, the Contractor hereby agrees to the following conditions:

1. To remove any and all identification of the Architect and consultants from title block prior to the use of the documents.
2. To add Contractor’s title block or the title block of Contractor’s supplier prior to reproducing the documents either electronically or in printed form.
3. Prior to reproducing any drawing, Contractor will verify the information and dimensions contained in the documents and assume the liability for the accuracy as if the drawings had been totally prepared by our own company.
4. Contractors agree that the use of these electronic files is specifically for this Project, these files will not be reproduced for any other project, and the Architect

has not waived the Architect's copyright or other reserved rights.

5. Contractors agree to release and indemnify the Owner, Architect, and Construction Manager and their consultants against any losses or claims as a result of any errors or omissions in the electronic data.
6. Electronic files are not construction documents. Differences may exist between the electronic files and corresponding hard-copy construction documents. The Architect and Owner make no representation regarding the accuracy or completeness of the electronic files. In the event that a conflict is discovered between the hard copy construction documents and the electronic files, hard-copy construction documents shall govern. The Contractor is responsible for determining if any conflict exists.
7. The use of the electronic files does not relieve the Contractor of fully complying with the Contract Documents or the need to check, confirm, and coordinate all dimensions and details, take field measurements, verify field conditions, and coordinate your work with that of other contractors for the Project.

E. See attached form "Attachment A – Electronic Media and 3D Computer Model Release & Terms of Use Agreement".

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION – (Not Applicable)

END OF SECTION 01 31 26

ALLOY5 ARCHITECTURE

530 WEST BROAD STREET
BETHLEHEM, PA 18018
610.419.4055
WWW.ALLOY5.COM

ELECTRONIC FILE AGREEMENT

PROJECT NAME / NUMBER:

RECIPIENT REQUESTING DOCUMENTS:

DATA / DOCUMENT REQUESTED:

The following **Alloy5 Architecture** ("A5") agreement to release certain Electronic Files/Documents ("ELECTRONIC Files"), the RECIPIENT agrees as follows:

I. A5 will provide to the RECIPIENT certain drawings, specifications, or other documents prepared by A5 or its sub consultants in electronic format and/or on electronic media. These documents are hereinafter collectively referred to as "ELECTRONIC Files". The ELECTRONIC Files are instruments of A5's services performed solely for the owner/Client's benefit and to be used solely for this Project. A5 does not represent that the information contained in the ELECTRONIC Files are suitable for use on any other project or for any other purpose. If the ELECTRONIC Files are used for any other project or purpose without A5's specific written permission, the risk of such use shall be assumed solely by RECIPIENT or other user. Prior to any reuse of the ELECTRONIC files for another purpose, A5 and the RECIPIENT shall agree on the amount and method of payment of additional compensation to which A5 shall be entitled.

II. The ELECTRONIC Files are provided merely as a convenience to the RECIPIENT. The ELECTRONIC Files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Drawings for use on the project.

III. A5 makes no representation, warranty or guarantee that ELECTRONIC Files: (1) are suitable for any other usage or purpose, or (2) have any particular, durability, or (3) will not damage or impair the Recipient's computer or software, or (4) contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the RECIPIENT.

IV. Due to the unsecured nature of the ELECTRONIC Files and the inability of A5 or the RECIPIENT to establish controls over their use, A5 assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the RECIPIENT to check the validity of all information contained herein. The RECIPIENT shall at all times refer to the signed and sealed drawings of the project during all phases of the project. The RECIPIENT shall assume all risks and liabilities resulting from the use of this data, and the RECIPIENT agree(s) to waive any and all claims and liability against A5 and its sub consultants resulting in any way from the use of the ELECTRONIC Files.

V. RECIPIENT also agree(s) to defend, indemnify and save harmless A5, its sub consultants, officers, agents, employees, and shareholders from and against any and all claims, damage, liability, costs, judgment, suit, or expense (including reasonable defense and attorney fees) arising in any manner from the use, reuse, or modification of the ELECTRONIC Files.

Please execute this Agreement in the space provided below to indicate your acceptance of the terms and conditions of the release itemized in this Agreement. Upon receipt of the executed Agreement, we will transfer

the CADD Files to the address or email provided below.

READ AND ACCEPTED BY:

Signature of Authorized Representative: _____
Date: _____

Printed Name: _____ Company: _____
Title: _____

SECTION 01 32 00 – CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction, including:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.
4. Daily construction reports.
5. Material location reports.
6. Field condition reports.
7. Special reports.

B. All Work under the Contract Documents shall be planned, scheduled, executed, and reported using a cost- and resource-loaded Critical Path Method (CPM) schedule expressed in calendar days, excluding Saturdays, Sundays, and legal holidays.

C. General Scheduling Authority: The General Contractor is designated as the Project Coordinator unless noted otherwise. The provisions of the General Requirements, Division 01, and the directions of the Project Coordinator are to be followed by the Contractor in scheduling and coordinating construction activities. The scheduling Services of the Project Coordinator are part of its contract with the Owner, but nothing herein relieves the obligations of each Contractor to schedule their own construction activities, and nothing herein alters the obligation of each Contractor to resolve all supervision, coordination, and scheduling issues between and among the Sub-Contractors. In addition, the requirements for subordinate coordination responsibilities and scheduling per the Division 01 General Requirements must be followed by all contractors. The Construction Manager and Owner, at their sole discretion, may waive or modify any scheduling requirement including format, content, and complexity. Any such waiver shall not be grounds for a claim by the Contractor against the Owner, Construction Manager, or Architect.

D. Electronic Submission Standard: All schedules and updates shall be submitted in electronic format with no restrictions for viewing and analyzing, using the same software with which the schedule was created. Electronic files shall be submitted to the Construction Manager and to any Contractor the Construction Manager directs.

1.03 RELATED SECTIONS

A. Coordinate with the following Division 01 Sections:

1. Section 01 11 00 “Summary of the Project” for a summary of Owner-furnished products.
2. Section 01 12 00 “Multiple Work Scope Summary” for preparing a combined Contractor’s Construction Schedule.
3. Section 01 29 00 “Payment Procedures” for the Schedule of Values procedures and submission.
4. Section 01 31 00 “Project Management and Coordination” for meeting minutes; Prescheduling Conference.
5. Section 01 33 00 “Submittal Procedures” for schedule and report submissions; submittal review times.
6. Section 01 40 00 “Quality Requirements” for submission of a schedule of tests and inspections.
7. Section 01 77 00 “Closeout Procedures” for required Project Record Documents at closeout.

1.04 DEFINITIONS

A. Activity: A discrete, schedulable part of the Work that consumes time and resources. Activities include shop drawing preparation, construction operations, equipment testing, training, and any other action required for prosecution of the Work.

1. Critical Activity: An activity on the critical path that must start and finish on its planned early start and finish dates.
2. Predecessor Activity: An activity that must be completed before a given activity can begin.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: Allocation of a dollar value to each schedule activity. The sum of all activity costs must equal the total Contract Sum unless otherwise approved by the Architect.
C. CPM (Critical Path Method): A scheduling method in which activities are arranged based on their logical relationships. Network calculations determine when activities can be performed and identify the critical path.
D. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration. Activities on the critical path have the lowest total float value.
E. Event: The starting or ending point of an activity.
F. Float**:** The measure of leeway in starting and completing an activity.

1. Float belongs to the Owner and may be assigned only with the Owner’s representative’s approval.
2. Free Float: The amount of time an activity can be delayed without adversely affecting the early start of the immediately following activity.
3. Total Float: The amount of time an activity can be delayed without adversely affecting the planned Project completion date.

G. Fragnet: A partial or fragmentary network used to break down activities into smaller activities for greater detail, or to analyze the impact of a change.
H. Major Area: A story of construction, a separate building, or a similar significant construction element.
I. Milestone: A key or critical point in time used for reference or measurement.
J. Network Diagram: A graphic diagram of a network schedule showing activities and their relationships.
K. Notice to Proceed (NTP): The written notice from the Owner or Construction Manager authorizing the Contractor to begin the Work and establishing the date from which Contract Time is measured.
L. Resource Loading: The allocation of manpower and equipment to each activity as required to complete it within its scheduled duration.
M. Schedule of Values: A statement furnished by the Contractor allocating the entire Contract Sum among the various portions of the Work, used as the basis for reviewing Applications for Payment.

1.05 SUBMITTALS

A. Qualification Data: Submit credentials for the scheduling firm or in-house scheduling personnel, demonstrating CPM experience. Reference Article 1.6 of this Section for complete qualification requirements. Include a list of completed projects with project names, addresses, Architect and Owner contacts, and other relevant information.
B. Submittals Schedule: Submit within twenty business (20) days in tabular format including the following for each submittal:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's and all consultants' and agencies' final release or approval.

C. Preliminary Construction Schedule: Submit one (1) electronic copy within ten (10) business days of the Notice to Proceed. Approval of the cost-loaded preliminary schedule does not constitute approval of the Schedule of Values for cost-loaded activities.
D. Preliminary Construction Schedule Network Diagram: Submit one (1) electronic copy, at a scale large enough to show the entire network for the entire construction period. Show logic ties for all activities.
E. Final Construction Schedule: Submit one (1) electronic copy no later than twenty (20) business days of approval of the Preliminary Project Schedule. Label each submittal to identify the schedule type (initial or updated) and date.
F. Final Construction Schedule Reports: Submit one (1) copy of each of the following computer-generated reports with the Final Construction Schedule. Each activity entry shall include: activity number, description, cost and resource loading, original duration, remaining duration, early start, early finish, late start, late finish, and total float in calendar days.

1. Activity Report: All activities sorted by Project Phase, Project Area, Prime Contractor, then early start date. Include duration, cost, and total float for each activity.
2. Logic Report: Preceding and succeeding activities for all activities, sorted in ascending order by activity number, then early start or actual start date if known.

G. Field Reports — Submission Frequency:

1. Daily Construction Reports: Submit electronically via the Procore Daily Log tool on a daily basis. Incomplete or late reports may result in partial withholding of monthly payment applications.
2. Material Location Reports: Submit one (1) electronic copy at monthly intervals.
3. Field Condition Reports: Submit one (1) electronic copy immediately upon discovery of differing conditions.
4. Special Reports: Submit one (1) electronic copy within one (1) day of an unusual event.

1.06 QUALITY ASSURANCE

A. Scheduler's Qualifications: The Contractor shall engage a scheduling specialist with a minimum of five (5) years of experience in the design, preparation, publication, and revision of CPM network schedules, including experience on at least three (3) multi-prime and multi-phase construction projects. The specialist shall be capable of producing CPM reports and diagrams within 24 hours of the Construction Manager's request.

B. The Contractor shall submit the name, credentials, and experience of the proposed scheduling consultant to the Owner, Architect, and Construction Manager for approval within five (5) business days of Notice to Proceed. The Contractor may not terminate an approved scheduling consultant without at least thirty (30) days' prior written notice and concurrent approval of a replacement. If the Construction Manager makes reasonable objection to any scheduling consultant, the Contractor shall promptly replace that consultant.

C. Alternative Qualification: If the Contractor demonstrates to the Construction Manager's satisfaction that it employs in-house personnel with equivalent CPM qualifications, the Owner may grant written approval to use that employee as the scheduling consultant.

D. Prescheduling Conference: Before schedule preparation begins, conduct a conference at the Project site per Division 01 Section 01 31 00. Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule. Agenda shall include, at minimum:

1. Software limitations; report content and format.
2. Availability of qualified scheduling personnel.
3. Project constraints: phasing, work stages, area separations, interim milestones, and partial Owner occupancy.
4. Owner-furnished product delivery dates.
5. Work of Owner's separate contracts.
6. Submittal and resubmittal review times per Section 01 33 00.
7. Test and inspection requirements.
8. Time required for completion and startup procedures.
9. Final list of construction activities to be included in the schedule.

10. BIM and 3D/4D schedule coordination requirements, if applicable per Article 2.5.
11. Schedule update procedures.

1.07 COORDINATION

A. Coordinate the preparation and processing of all schedules and reports with the performance of construction activities and with the scheduling and reporting obligations of separate contractors.
B. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
C. Secure time commitments for performing critical elements of the Work from all parties involved.
D. Coordinate each construction activity in the network with all other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Preparation: Submit a Submittals Schedule arranged in chronological order by dates required by the construction schedule. When establishing dates, include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery.
B. Coordinate the Submittals Schedule with the list of subcontracts, Schedule of Values, and Contractor's Construction Schedule.
C. Initial Submittal: Submit concurrently with the Preliminary Construction Schedule. Include all submittals required during the first ninety calendar (90) days of construction and those required early due to long lead times for manufacture or fabrication.
D. Final Submittal: Submit concurrently with the first complete submittal of the Contractor's Construction Schedule.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE — GENERAL REQUIREMENTS

A. Procedures: Comply with the Associated General Contractors' publication "Construction Planning and Scheduling."
B. Time Frame: Extend the schedule from the date established for the Notice to Proceed to the date of Final Completion. Contract completion dates shall not be changed by submission of a schedule showing an early or late completion date unless specifically authorized by Change Order.
C. Computer Software: Prepare all schedules using Owner-approved CPM scheduling software. Submit the proposed software for approval at the Prescheduling Conference. The following Oracle Primavera products are pre-approved; other platforms require written Owner approval before use.

1. Oracle Primavera P6 Professional Project Management (P6 PPM).
2. Oracle Primavera P6 Enterprise Project Portfolio Management (P6 EPPM).

3. Oracle Primavera Cloud.

D. Activity Requirements: Each activity on the network shall include:

1. Duration: A single duration of no more than twenty (20) working days, representing the best estimate of elapsed time for the scope of work involved. Normal holidays and anticipated weather delays shall be incorporated. One critical path shall be shown for the schedule.
2. Identification Number: Assigned to each activity in a format acceptable to the Project Coordinator.
3. Description: A brief, definitive description of the activity. If not sufficiently definitive, a separate listing with a descriptive narrative shall be provided.
4. Cost Loading: Each activity shall be cost-loaded to show its total estimated budget. No single activity budget shall exceed the lesser of $50,000 or one-half of one percent (0.5%) of the total Contract Price, except for procurement and mobilization activities which may exceed this threshold with the Construction Manager's written approval. Material and equipment costs to be paid as stored materials shall be listed separately. Activities shall also be cost-loaded as directed by the Owner's representative for payment purposes.
5. Man-Hour Loading: Each activity (except procurement activities) shall be loaded with the estimated man-hours to be expended.
6. Procurement Activities: Long-lead and major procurement items requiring more than forty (40) calendar days shall be included as separate activities covering submittals, approvals, purchasing, fabrication, and delivery.
7. Submittal Review Time: Include review and resubmittal times per Division 01 Section 01 33 00. Coordinate with the Submittals Schedule.
8. Substantial Completion: Show completion in advance of the Substantial Completion date and include time for Architect's and Owner's administrative procedures required for certification.

E. Constraints: Include all constraints and work restrictions in the schedule and show how each affects the sequence of Work, including:

1. Phasing: Arrange activities by phase.
2. Multiple Contracts: Include separate activities for each prime contract and for each portion of Work performed by the Owner.
3. Products Ordered in Advance and Owner-Furnished Products: Include a separate activity for each product. Reference included Project Phasing Schedule Dates stipulate the earliest possible delivery.
4. Work Restrictions: Show the scheduling effect of coordination with existing construction, occupancy limitations, uninterruptible services, partial occupancy before Substantial Completion, use-of-premises restrictions, provisions for future construction, seasonal variations, and environmental controls.
5. Work Stages: For each Phase, indicate stages of construction including subcontract awards, submittals, purchases, mockups, fabrication, sample testing, deliveries, installation, shop and field tests and inspections, traffic pattern changes, moving and occupancy timeframes, adjusting, curing, startup and placement into final use and operation, and punchlist.
6. Area Separations: Identify each major area of construction per Phase and show where activities must be sequenced to meet the following milestone dates:

Foundation Completion, Structural Completion, Permanent Space Enclosure, Completion of Mechanical Installation, Completion of Electrical Installation, and Substantial Completion.

F. Milestones and Phases: Include all milestones and phases identified in the Contract Documents, including Notice to Proceed, Individual Phase Completions, Substantial Completion, Final Completion, and all interim milestones listed in the Contract Documents.

G. Cost Correlations for Progress Payments: Provide cost loading of both the Preliminary and Final schedule as follows:

1. Each activity shall be allocated a dollar value consistent with Article 2.2.D above. Each activity's cost shall consist of labor, equipment, and materials costs plus a pro-rata contribution of overhead and profit. The sum of all activity costs shall equal the total Contract Price. By submitting cost data, the Contractor certifies the costs are not unbalanced and that the value assigned to each activity represents Contractor's estimate of the actual costs of performing that activity.
2. The accepted schedule of values shall represent a fair, reasonable, and equitable cost allocation for each activity.
3. If the Owner's representative determines that cost data does not meet the requirements for a balanced-bid breakdown, the Contractor shall provide documentation substantiating the allocation. Cost allocations shall be considered unbalanced if any activity has been assigned a disproportionate share of direct costs, overhead, or profit.

H. Contract Modifications: For each proposed contract modification, prepare a time-impact analysis using fragnets concurrently with the modification submission to demonstrate the effect of the proposed change on the overall Project schedule.

2.03 PRELIMINARY CPM CONSTRUCTION SCHEDULE

A. Format: Submit a preliminary horizontal bar-chart schedule within ten (10) business days of the Notice to Proceed.

B. Content: Show each significant construction activity separately. Identify the first workday of each week with a continuous vertical line. Include construction activities for the first ninety (90) days and costs for each activity.

2.04 FINAL CPM CONSTRUCTION SCHEDULE

A. Format: Prepare the Contractor's Construction Schedule as a computerized, cost- and resource-loaded, time-scaled CPM network analysis diagram. Use "one workday" as the unit of time. Include a list of all non-working days and holidays.

1. The final Project schedule must be completed within 20 business days of approval of Preliminary Project schedule.
2. Train and inform key Project personnel, including each contractor's 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.

B. Preparation:

1. Prepare a complete list of activities required to complete the Work and develop a network diagram from the preliminary schedule to identify all critical paths.
2. For each activity, indicate estimated time duration, sequence requirements, and relationships to other activities. Include within each Phase: preparation and processing of submittals, mobilization and demobilization, purchase of materials, delivery, fabrication, utility interruptions, installation, Owner's Work, and testing and commissioning.
3. Identify critical path activities, including those for interim Phase completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
4. Process data to produce output on a computer-drawn, time-scaled network. Revise and reproduce as necessary to produce an acceptable schedule within Contract Time.
5. Format: Mark the critical path and locate it near the center of the network. Locate paths with the most float near the edges.

C. Network Diagram Requirements: The CPM schedule shall be in the form of a time-scaled precedence diagram, flowing continuously from left to right, and shall include:

1. A shop drawing and submittal schedule noting submittal, approval, order, fabrication, and delivery durations.
2. Integration of the submittal schedule with installation activity logic to show the effect of delivery on installation.
3. Planned progression of construction showing activities, durations, and interim milestone dates for each contract phase.
4. Logic restraints that clearly identify interrelationships of work, crew, and trade flow.
5. CPM logic diagrams summarized in a bar chart format capable of displaying current progress for all Work.
6. A computerized mathematical analysis of CPM logic showing activity duration, early and late start and finish dates, tasks critical to completion, and interim milestone dates on a monthly basis.
7. Crew sizes and planned labor hours for each activity.

D. Weather Calendar: The CPM schedule shall include a weather calendar showing non-working days beyond standard weekends and holidays to account for anticipated inclement weather for the project area.

E. Initial Schedule Issue: Prepare the initial network diagram from an early-start/total-float sort. Identify critical activities and prepare tabulated reports showing:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediately 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. Dollar value of activity (coordinated with the Schedule of Values).

F. Schedule Updating — Monthly Tabulated Reports: Concurrently with each schedule revision, prepare tabulated reports and updated electronic files on a monthly basis showing:

1. Activities that have changed.
2. Original Duration
3. Predecessors/Predecessor Lag.
4. Successors/Successor Lag..
5. Calendars

2.05 FIELD REPORTS

A. Contractor is to submit Daily Construction Reports on a daily basis to the Owner's Representative using the Daily log tool in Procore. Failures to maintain timely or complete reports may result in partial withholding of monthly payment applications.

2.06 SPECIAL REPORTS

A. Submit special reports directly to the Owner within one (1) day of an occurrence. Distribute copies to all affected parties.

B. When an unusual or significant event occurs at the Project site, whether or not directly related to the Work, prepare and submit a special report documenting: the chain of events, persons involved, Contractor's response and personnel actions, evaluation of results or effects, and similar pertinent information. Advise the Owner in advance when such events are known or predictable.

PART 3 - EXECUTION

3.01 PROJECT COORDINATOR RESPONSIBILITIES

A. The General Contractor is designated as the Project Coordinator unless the Contract Documents state otherwise. The Project Coordinator is responsible for making all coordination decisions not mutually agreed to by all affected Prime Contractors.

B. Disputes between or among the Project Coordinator and one or more other Prime Contractors and disputes in connection with the construction schedule, the furnishing of additional resources to meet the Project schedule, job coordination, and all aspects of the means and methods shall be submitted promptly to the Project Coordinator for a final construction decision. The Project Coordinator and all affected Prime Contractor(s) shall, in connection with all submissions for a final construction decision, simultaneously

provide written notice to the Construction Manager of any such submissions. The final construction decision of the Project Coordinator must, at all times, be consistent with the content and intent of the Contract Documents and the latest accepted schedule.

C. If the Owner or Construction Manager determines that substantial interests are at risk due to the Project Coordinator's final construction decision, the Owner or Construction Manager reserves the right to overrule it. The exercise of discretion by the Owner or Construction Manager in this regard shall be unchallengeable except upon a finding of abuse of discretion. In all other instances, the Project Coordinator's final construction decision shall be observed and followed by all Prime Contractors and their Subcontractors, even pending any litigation between Prime Contractors.

D. The damage remedy available to the Project Coordinator or any other Prime Contractor shall be the exclusive remedy for disputes between contractors. No Contractor, including the Project Coordinator, shall have any right of action against the Owner, Architect, or Construction Manager in connection with such disputes.

E. As Project Coordinator, the General Construction Contractor shall:

1. Engage the approved scheduling consultant to carry out the Contractor's CPM scheduling duties. The consultant shall not be terminated without thirty (30) days' prior written notice.
2. Attend and chair meetings at least every two weeks during construction with all separate contractors, the Owner, the Architect, and Construction Manager to review progress and to plan and coordinate the activities of each separate contractor with the Work of the Contractor and of the Owner.
3. Ensure that reporting related to the Owner, Architect, and Construction Manager delays, or potential delays.
4. Formulate and recommend plans, including a revised Project schedule, to prevent, minimize, or recover from delays.
5. Make recommendations regarding requests for extensions of time and their effect on the Project schedule.
6. Revise the Project schedule to reflect Owner-granted time extensions.
7. Resolve objections from other contractors and make schedule adjustments mutually agreeable to all Prime Contractors and the Owner.
8. Prepare monthly schedule updates comparing actual progress to scheduled progress.

3.02 CONTRACTOR SCHEDULING OBLIGATIONS (ALL CONTRACTORS)

A. All Contractors other than the Project Coordinator shall:

1. Within ten (10) business days after the Notice to Proceed, submit a preliminary construction schedule to the Project Coordinator and Construction Manager in a form compatible with the requirements herein, showing the Contractor's Work and all activity interdependencies with other contractors. If not accepted, revise and resubmit promptly per the recommendations of the Owner, Architect, Construction Manager, and Project Coordinator.
2. Within twenty (20) business days of approval of Preliminary Project schedule, submit a final construction schedule to the Project Coordinator and Construction Manager for incorporation into the overall Project schedule.

3. Cooperate and participate with the Project Coordinator and other contractors in all activities described in this Section.
4. Notify the Project Coordinator, Owner, and Construction Manager in writing of any objection to the Project construction schedule or any revision within two (2) business days of receipt. Failure to provide timely written notice constitutes waiver of any objection, and the Contractor shall comply with the schedule. If a timely objection is made, the Contractor and Project Coordinator shall resolve it within ten (10) days. If unresolved, the Owner may appoint the Construction Manager or an independent scheduling consultant whose decision shall be final and binding. All costs of resolving the objection shall be borne equally by the Contractor, the Project Coordinator, and their respective Sureties.
5. Not claim damages against the Owner or any adjustment in Contract Time or Contract Sum arising from the Project construction schedule, any revision, or any resolution of a schedule objection.
6. Acknowledge that the Owner has no duty to cause the Project Coordinator to perform competently, and that any claim arising from the Project Coordinator's failure to perform shall be solely against the Project Coordinator.

B. Early Completion: If any Contractor intends to complete the Work, or any portion thereof, earlier than any applicable Completion Date, it shall provide timely written notice to all other Contractors, the Project Coordinator, and the Construction Manager. The Project Coordinator has discretion to accept or reject such a plan. Earlier completion shall be promoted wherever feasible without affecting Work quality as determined by the Construction Manager. All Contractors shall cooperate and accelerate work as determined by Project Coordinator unless quality of work is affected as determined by the Construction Manager. No claims for acceleration to complete early or to meet project schedule will be considered.

C. Schedule Compliance and Costs: All costs associated with completing the Work within the Contract Time — including shift work, overtime, and premium time — shall be included in each Contractor's bid. Failure to include such costs in the bid does not relieve the Contractor of the obligation to use whatever means are necessary to meet Contract schedules. The Construction Manager, Architect, and Owner reserve the right to withhold monthly payment applications until the Contractor achieves schedule compliance. No claims for additional costs associated with completing the Work within Contract time frames will be considered.

D. Contractor Approval and Certification: Approval by the Contractor of any schedule or schedule revision constitutes the Contractor's representation that the schedule is a true and accurate plan to complete the Work, that it includes all Change Orders in the Contractor's possession, that it fully complies with the Contract Documents, and that the Contractor has coordinated and obtained concurrence from all affected parties.

E. Failure to Cooperate: The Contractor's failure to cooperate and participate in the development and review of construction schedules and updates as required by this Section shall be a material breach of the Contract, entitling the Owner to exercise all rights and remedies under the Contract Documents and applicable law.

3.03 NETWORK REQUIREMENTS

A. The CPM Schedule shall show the order and interdependence of all activities and the sequence in which the Work is to be accomplished. The schedule shall follow a time-

scaled precedence format, with the network diagram flowing continuously from left to right.

B. Contractor's Responsibility: Failure to include in the CPM schedule any element of Work required under this Contract shall not excuse the Contractor from completing all Work within the applicable completion time, notwithstanding the Owner's network review.

C. Early Completion Float: A CPM schedule showing completion prior to the contractual completion date may be accepted, but shall not serve as a basis for any delay claim or cost reimbursement against the Owner. The period between the Contractor's baseline accepted CPM schedules projected completion date and the contractual completion date, if any, shall be treated as Project Float, available to the Owner to utilize as per Article 3.8.

D. Unacceptable Schedule: If a submitted CPM Schedule shows a work plan that will not complete the Work within the Contract Time, the Contractor shall revise and resubmit until an acceptable schedule is produced. Failure to submit an acceptable schedule may, at the Owner's sole discretion, justify withholding of partial payments.

E. Owner's Non-Representation: Acceptance of the schedule does not constitute the Owner's representation that the Work can be completed as shown on the schedule.

F. Project Schedule Submittal and Approval: The Contractor shall submit the Project Schedule for all Work in conformance with the project schedule requirements listed in the project manual, including all phasing and milestones provided. The Project Coordinator shall incorporate all contractors' Work items and issue the consolidated Project schedule. Upon written approval of the schedule by the Contractor and Construction Manager, and review by the Architect, the schedule shall become the essence of the Contract with respect to time. Non-compliance may constitute a violation of the General Conditions article governing Delays and Extension of Time. The Project schedule may be revised only with written consent of the Construction Manager, Owner, and Architect. Non-compliance with scheduling requirements may result in a deduction of $800.00 per day from the Contract amount as a schedule administration charge; this deduction is in addition to, and does not limit, any other rights or remedies of the Owner under the Contract Documents, including enforcement of the General Conditions article governing Termination or Suspension by the Owner. No payment applications will be processed without an approved Project schedule accepted by all contractors.

G. Owner's Liability: Preparation, review, enforcement, and updating of the Project schedule do not make the Owner, Construction Manager, or Architect liable to the Contractor for time overruns, cost overruns, or schedule changes required to maintain Contract completion and milestone dates.

H. Contractor's Responsibility for Schedule Logic: The Contractor is solely responsible for determining the sequence and logic of activities, time estimates, and means and methods for its portion of the Work. The Construction Schedule shall represent the Contractor's best judgment of how it will prosecute the Work in compliance with the Contract Documents. Contractor shall ensure that the Construction Schedule is current and accurate and is properly and timely monitored, updated, and revised as Project conditions and the Con-tract Documents may require, and as may be directed by Project Coordinator

I. Subcontractor Coordination: The Contractor shall consult with its major Subcontractors when preparing the Construction Schedule. Major Subcontractors shall receive copies of relevant schedule portions and shall be continuously advised of updates. Submission of the schedule by the Contractor to the Project Coordinator constitutes confirmation that the Contractor has coordinated with and received concurrence from its major Subcontractors.

J. Milestone Dates: Completion and Milestone Dates in the Contract Documents are Contract requirements and are of the essence to the Contract. They represent the latest allowable completion times for the respective portions of the Work, not a complete listing of all interfaces. The Contractor shall determine all interface time requirements and shall plan, schedule, and coordinate accordingly.

3.04 SCHEDULE UPDATES

A. Monthly Schedule Update Meeting: A Schedule Update Meeting shall be held one (1) week prior to each monthly progress meeting at the Project site. The Project Coordinator and all Contractors shall attend. Actual progress for the previous month shall be recorded, future activities reviewed, and activity durations and logic connections revised as needed. Decisions agreed to by all parties are binding; contractual completion dates may be modified only through formal written requests accepted per the Contract Documents. Each Contractor shall provide, at a minimum:

1. Actual start and finish dates for all completed activities.
2. Actual start dates and estimated remaining durations for all activities in progress.

B. Monthly Progress Status Report: Submit an electronic copy of each monthly schedule update to the Construction Manager at the end of each month. The report shall include:

1. Revisions to the Construction Schedule since the previous submittal.
2. Work completed during the reporting period.
3. A printed copy of the entire updated schedule showing early and late dates, activity durations, predecessors, successors, and a list of logic and duration changes.
4. Work anticipated to start in the next period, including activities already in progress.
5. Problem areas, anticipated delays, and their impact on the schedule.
6. Recommended corrective action and its effect.
7. Effect of changes on schedules of other Prime Contractors.
8. Updated tabulation of Contract Time and a printed copy of the project critical path.
9. Overall evaluation of Project schedule status.

C. Application for Payment: Submission and acceptance of progress updates and progress reports are a prerequisite to Applications for Payment. The Contractor shall not be entitled to any progress payment until it has fully complied with the requirements of this Section.

D. Schedule Distribution: Distribute approved copies of the schedule to the Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and all parties with schedule responsibility. Post copies in Project meeting rooms and field offices. Update distribution whenever the schedule is revised; remove parties once their Work is complete.

E. CPM Schedule as Payment Basis: The CPM schedule shall be used to monitor progress and as the basis for monthly payments. Each Contractor shall provide all sequencing, logic, and duration information and the initial logic network diagram. Once accepted, the Contractor shall provide monthly update information including logic, percent complete, actual start and finish dates, and duration changes. The Project Coordinator shall produce computerized schedule printouts using information provided by all Contractors, and distribute updated schedules at progress meetings.

F. Schedule Integrity: Each Contractor's initial schedule and all updates shall represent that Contractor's and its Subcontractors' best efforts as to how the Work will be accomplished. All progress information shall accurately reflect actual performance. Once accepted, adherence to the CPM schedule is obligatory.

G. Work Commencement and Execution: Work shall begin on the date in the Notice to Proceed and shall be executed with sufficient progress to prevent delay to other Contractors or to the Project's overall completion. Each Contractor shall at all times schedule and direct its Work to provide an orderly progression to completion within the Contract Time.

H. Items not ordered by the Contractor in a timely manner for incorporation into the Work will not be considered as grounds for claims for additional time or costs.

3.05 SCHEDULE REVISION PROCEDURE

A. When a formal schedule revision is required — whether directed by the Owner, Construction Manager, or Project Coordinator, or triggered by the recovery schedule process under Article 3.6 — the Contractor shall prepare and submit a revised schedule meeting all of the following requirements:

1. The revised schedule shall be prepared to the same level of detail, format, and software requirements as the accepted baseline CPM schedule per Article 2.4.
2. The Contractor shall submit a written narrative explaining the basis for each change in activity logic, duration, sequence, or resource allocation.
3. The revised schedule shall be submitted to the Project Coordinator by the Prime Contractor initialing the change within five (5) business days of the directive or triggering event for incorporation by the Project Coordinator into the overall Project Schedule. This shall be for all cases unless a different time is specified in writing by the Construction Manager.
4. The Project Coordinator shall review and incorporate all Prime Contractors' revised work items and issue a consolidated revised Project schedule within five (5) business days of receipt of all Contractor submissions.
5. The revised schedule shall be reviewed and accepted by the Construction Manager and Owner prior to use. Acceptance does not modify Contract Time or Contract Sum unless effected by Change Order.

B. No revision to the Project schedule shall constitute grounds for an adjustment in Contract Time or Contract Sum unless such adjustment is agreed to by the Owner and authorized by Change Order.

3.06 RECOVERY SCHEDULES

A. Trigger: If the updated Construction Schedule shows, in the Construction Manager's sole opinion, that any Contractor is ten (10) or more calendar days behind schedule for any Completion Date, that Contractor shall, within five business (5) days of written notice from the Construction Manager, prepare and submit a recovery schedule at no cost to the Owner explaining and displaying how Contractor intends to reschedule his Work in order to regain compliance with the Construction Schedule during the immediate

subsequent pay period. The Contractor shall also coordinate required schedule changes with the Project Coordinator for incorporation into the overall schedule.

B. Recovery Period: If the Contractor believes all lost time can be recovered within one pay period, it shall prepare a limited-duration recovery schedule as set forth herein. If recovery will require more than thirty (30) days, the Contractor shall instead prepare and submit a formal schedule revision per Article 3.5.

C. Recovery Schedule Content: The recovery schedule shall be prepared to the same level of detail as the Construction Schedule, for a maximum duration of one month, incorporating the best available information from Subcontractors and others. It shall be prepared in coordination with all other Prime Contractors.

D. Review Conference: Within two business (2) days after submission of a recovery schedule, the Contractor shall participate in a conference with the Project Coordinator and Construction Manager to review and evaluate it. Within two business (2) days of that conference, the Contractor shall submit any required revisions for acceptance. The Contractor shall then execute the Work per the accepted recovery schedule.

E. Ongoing Assessment: Each Contractor shall confer continuously with the Project Coordinator to assess recovery effectiveness. If the Construction Manager determines the Contractor remains behind schedule, the Project Coordinator shall direct preparation of a formal schedule revision per Article 3.5. If the Project Coordinator determines the Contractor has successfully complied with the recovery schedule, it shall direct the Contractor to return to the accepted Construction Schedule.

F. Nothing in this Article alters the Project Coordinator’s obligation to resolve coordination and scheduling disputes among Prime Contractors.

3.07 CAUSES FOR EXTENSIONS OF TIME

A. General: Contract Times will be adjusted only for causes specified in this Contract. Any Contractor requesting an extension of Contract Time shall provide justification and supporting evidence as required elsewhere in the Contract Documents. Delays to activities that do not affect any Contract completion date shown on the critical path shall not be the basis for a change in Contract Time.

B. Weather Delay Extensions: Extensions for weather delays shall be granted only upon satisfaction of all of the conditions listed in Section 15.1.6.2 of the General Conditions.

3.08 OWNER-INITIATED SCHEDULE ADJUSTMENTS

A. The Owner may direct schedule adjustments due to job conditions, acts or omissions of other contractors, acts of God, technical difficulties, unavoidable Owner delays, or other unforeseeable conditions. Under such conditions, Owner shall direct Contractor to reschedule the Work to reflect the changed conditions, and the Contractor shall revise its schedule accordingly per Article 3.5. Only the Owner, in writing, may grant schedule extensions that affect Contract Time. No additional compensation shall be paid for such adjustments except for unavoidable overall Contract delays, in which case the Contractor shall take all possible action to minimize the time extension. Available Project Total or Free Float may be applied by the Owner to accommodate adjustments without requiring a formal time extension.

B. Owner’s Corrective Measures: If the Owner determines that the Work has not progressed to the required level of completion, the Owner may order the Contractor to

take corrective measures including: working additional shifts or overtime; supplying additional manpower, equipment, and facilities; engagement of a scheduling consultant (cost to be allocated among responsible parties by the Architect and Construction Manager in their sole discretion); and other similar measures. Such measures shall continue until progress complies with the required level of completion. The Owner's right to require these measures shall not impose any duty or obligation to the Contractor or its Surety.

1. If the Contractor has not caused or contributed to the failure to progress, it shall be entitled to a Change Order for the reasonable additional labor cost of Owner-directed overtime or shift work.
2. If the Contractor has caused or contributed to the failure to progress, the Contractor and its Surety shall be liable for all costs incurred by the Owner, including the cost of any overtime or shift work by the Owner or separate contractors.
3. If the Contractor fails to perform as Project Coordinator adequately or to the Owner's satisfaction, the Owner may appoint a substitute Project Coordinator chosen from the separate contractors or an independent consultant. The cost of the substitute Project Coordinator shall be charged to and borne by the Contractor and its Surety.

3.09 FLOAT TIME

A. Float belongs to the Owner. The Owner may initiate changes that absorb available float without any obligation to extend overall or intermediate completion dates. Owner-initiated changes that affect the critical path on the CPM network shall be the sole grounds for extending or shortening those dates.
B. Contractor-initiated changes that encroach on total float may be accomplished with the Owner's concurrence but shall give way to any competing Owner-initiated change requiring the same float.

END OF SECTION 01 32 00

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment.
2. Division 01 Section "Closeout Procedures" for submitting warranties and Project Record Documents.

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Engineer's responsive action.
B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.04 SUBMITTAL PROCEDURES

A. General: Prepare and submit Action Submittals required by individual Specification Sections.
B. Submit each submittal online, via Procore, where the Construction Manager, and/or Engineer will review and return electronically to the contractor. Mark up and retain one (1) returned copy as a Project Record Document.
C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal via Procore with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of a need to review submittals concurrently for coordination.

a. Construction Manager/Engineer or Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Submittals Schedule: Comply with requirements in Division 01 for list of submittals and time requirements for scheduled performance of related construction activities. The Construction Manager will coordinate the initial submittal schedule between the Primes and the Architect/Engineer. The Construction Manager will then post all submittals from the final submittal schedule and set up the workflow in Procore.

E. Processing Time: Allow enough time for submittal review, including time for resubmittals. Construction Manager / Engineer shall have 3 weeks collectively to return submittal reviews.

F. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches (100 by 125 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Engineer.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Unique identifier, including revision number.
    i. Number and title of appropriate Specification Section and paragraphs.
    j. Drawing number and detail references, as appropriate.
    k. Other necessary identification.

G. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals. No substitutions will be accepted without approval by addendum prior to bid.

H. Additional Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies (if applicable) via Procore.
2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

I. Transmittal: Package each submittal individually and appropriately for transmittal and handling via the required submittal log within Procore. Construction Manager/Engineer will return submittals, without review, that are received from sources other than assigned Contractor.

1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Construction Manager/Engineer on previous submittals, and deviations from

requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.

2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

J. Distribution: Furnish copies (if required) of final submittals to manufacturers, subcontractors, suppliers, fabricators, and installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals with mark indicating action taken by Construction Manager/Engineer in connection with construction.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Submit each submittal online with cover sheet as indicated above, via Procore, where the Construction Manager and/or Engineer will review and return electronically to the contractor. Mark up and retain one (1) returned copy as a Project Record Document.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment. Submit individually as identified with Procore.

1. If information must be specially prepared for submittal because standard printed data are not suitable 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 written recommendations.
b. Manufacturer's product specifications
c. Manufacturer’s installation instructions.
d. Standard color charts.
e. Manufacturer’s catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operating and maintenance manuals.
k. Compliance with recognized trade association standards.
l. Compliance with recognized testing agency standards.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

C. 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.

1. Preparation: Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Submit electronic copies of each submittal and cover sheet, unless prints are required for operation and maintenance manuals. Submit four (4) prints where prints are required for operation and maintenance manuals. Construction Manager/Engineer and CM will each retain one (1) print; remainder will be returned. Mark up and retain one (1) returned print as a Project Record Drawing.

D. Samples: Prepare physical units of materials or products, including the following:

1. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.
2. 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.
3. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.

a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.

1. Provide sample substitutions where applicable if samples do not meet standards or are not approved due to an issue with quality, quantity, etc.

b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, and details of assembly, connections, operation, and similar construction

characteristics.

4. Number of Samples for Initial Selection: Submit one (1) full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.
5. 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 not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

PART 3 – EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
B. Approval Stamp: Stamp each submittal with a uniform approval stamp. Include Project name and location, submittal number, Specification Section title and number, 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.

3.2 CONSTRUCTION MANAGER’S/ENGINEER'S ACTION

A. General: Construction Manager/Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
B. Action Submittals: Construction Manager/Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it within 3 weeks. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
C. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 01 33 00

SECTION 01 40 00 – QUALITY REQUIREMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.
B. This Section specifies the general requirements for testing and inspection services. Testing and inspecting 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-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Cooperate with Owner's testing laboratory and all others responsible for testing and inspecting the Work.
D. Provide other testing and inspecting as specified to be furnished by the Contractor in this Section and/or elsewhere in these Specifications.
E. Provide quality control by the observation and acceptance of work by others being built upon.
F. Related work described elsewhere:

1. See Individual Specification Sections or Construction Drawings for specific test and inspection requirements.
2. Where no testing requirements are described, but the Engineer/Architect and/or Construction Manager decides that testing is required, they may direct that such testing be performed under current standards for testing and the General Conditions.

G. Selection of testing laboratory: The Owner shall hire and pay for an independent testing laboratory.

1.03 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.
C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.04 SUBMITTALS

A. Qualification Data: 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.
B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, 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.
C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

D. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number 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. Ambient conditions at time of sample taking and testing and inspecting.
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 re-inspecting.

E. Permits, Licenses, and Certificates: For Owner's records, 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.

1.05 QUALITY ASSURANCE

A. 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.
B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
C. Installer Qualifications: A firm or individual experienced in installing, erecting, 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.
D. 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.
E. Registered Engineer Qualifications: A registered 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 products that are similar to those indicated for this Project in material, design, and extent.
F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

    1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

H. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.

    1. Contractor responsibilities include the following:

        a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies

to adequately demonstrate capability of product to comply with performance requirements.

b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.
d. When testing is complete, remove assemblies; do not reuse materials on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor and Construction Manager. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.06 QUALITY CONTROL

A. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 72 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

1. Testing agency will notify Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

5. Testing agency will retest and reinspect corrected work at the expense of the Contractor.

C. 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.

D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies 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 inspecting. 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 inspecting equipment at Project site.

G. 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 inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.07 CODES AND STANDARDS

A. Testing, when required, will be in accordance with pertinent codes and regulations and with selected standards of the American Society for Testing and Materials (ASTM).

1.08 REVIEW OF THE CONTRACT DOCUMENTS

A. On all Project Drawings, figures take precedence over measurement by scale, and any scaling is done at the Contractor's own risk. Before ordering any materials or performing any Work, the Contractor shall verify all measurements at the project site and be responsible for the correctness of same.
B. Promptly respond to test reports and related instructions to ensure necessary retesting and replacement of materials with the least possible delay in progress of the Work.

1.09 FIELD CONDITIONS

A. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions with the Contract Documents and any shop drawings and product data before commencing any related work. Errors, inconsistencies, or omissions shall be reported to the Engineer/Architect and/or the Construction Manager at once.

1.10 PAYMENT FOR TESTING

A. Initial Services: The Owner's Testing Laboratory shall be responsible for initial testing services as outlined in various sections and the General Conditions.
B. Re-Testing Services: When initial tests indicate non-compliance with the Contract Documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same testing agency and the costs thereof will be borne by the Contractor responsible for the work that is non- compliant.

1.11 TESTING

A. Code Compliance Testing: Inspections and tests required by codes or ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.
B. Contractor's Convenience Testing: Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.12 INSPECTION

A. Inspection by Owner's Personnel: From time to time, personnel in the employ of the Owner may inspect the Work where the Work is in progress, but shall have no authority to direct the Contractor or request changes in the Work except through the Engineer/Architect and/or the Construction Manager.
B. Inspection of Work by Others: Each Contractor shall inspect Work of others which will receive or is adjacent to his Work before commencing his Work. Do not proceed until conditions which would result in a less than first class installation are satisfactorily corrected. Commencing Work shall be construed as acceptance of the Work of others, by the Contractor, as satisfactory to receive his Work. The Contractor shall bear all costs to correct the unsatisfactory Work.

1.13 COOPERATION WITH TESTING LABORATORY

A. Representatives of the testing laboratory shall have access to the Work at all times. Provide facilities for such access in order that the laboratory may properly perform its function.
B. Specimens and samples for testing, unless otherwise provided in the Contract Documents, will be taken by the testing personnel. Sampling equipment and personnel will be provided by the testing laboratory. Deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.
C. Test results and reports shall be furnished simultaneously to the Engineer/Architect and the Owner/Construction Manager through Procore within one (1) week of testing.

1.14 TESTING SCHEDULE

A. The Owner shall pre-qualify and identify qualified independent inspection agencies in a timely manner, allowing Engineer/Architect adequate time for review and approval.
B. Special Structural Testing Schedule to be implemented per specifications.
C. When changes to construction schedule are necessary during construction, the Contractor shall coordinate such changes of schedule with the testing laboratory as required.
D. When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay may be back charged to the Contractor and shall not be borne by the Owner.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 ACCEPTABLE TESTING AGENCIES

A. Recognized and/or licensed firms qualified to conduct the required testing.

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
2. Comply with the Contract Document requirements for Division 01 Section 01 73 29 "Cutting and Patching."

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 01 40 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.02 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 including humidification or dehumidification.
5. Electric power service.
6. Lighting.
7. Internet 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 00 73 19, “Safety.”
2. Section 01 11 00 "Summary of Work" for use of Project premises, limits of use, and limitations on utility interruptions.
3. Section 01 12 00 "Multiple Work Scope Summary".
4. Section 01 33 00 "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
5. Section 01 73 00 "Execution" for progress cleaning requirements.
6. Divisions 23 through 28 for temporary heat, ventilation, and humidity requirements for products in those Sections.
7. Division 32 Sections for construction and maintenance of asphalt paving and cement concrete pavement for temporary roads and paved areas.

1.03 DEFINITIONS

A. Permanent Enclosure: As determined by Architect and Construction Manager, 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.

1.04 DIVISION OF RESPONSIBILITIES

A. Assignment Control: Contractor assignments in Article 1.05 and Parts 2 and 3 are stated at the point of requirement for convenience and are intended to be consistent with this Article. If assignments appear to conflict, the more specific assignment governs

B. General: Each Prime Contractor is assigned specific responsibilities for temporary services and facilities, including some used by other Prime Contractors and other entities at the site. The Contractor for General Construction is responsible for temporary services and facilities that are not normal construction activities of other Prime Contractors, are not assigned to the Construction Manager, and are not specifically assigned otherwise in this Article. Responsibilities expressly assigned to the Construction Manager or to another Prime Contractor govern over this general division. All Contractors shall review this Section for requirements applicable to their Contracts.

C. CONSTRUCTION MANAGER (CM) is responsible for and shall provide:

1. One (1) construction trailer for Construction Manager, Owner, AHJ, and project meeting use.
2. Waste Disposal Facilities and Dumpsters: The Construction Manager shall furnish, maintain, relocate as necessary, haul, and pay disposal fees for common construction dumpsters required for construction operations. Common construction dumpsters shall be available for use by all Prime Contractors for ordinary construction waste generated by their Work.

3. The Construction Manager's dumpster responsibility does not include dumpsters required specifically for demolition of the existing building included in the General Contractor's Contract, hazardous or regulated materials, or materials prohibited from disposal in the common construction dumpsters.
4. Construction Manager shall provide the dumpsters for all on-site construction activities with the exception of demolition. Demolition waste is the responsibility of each Prime Contractor under Paragraph D.14.
5. Provide and maintain temporary toilets per 2.03.B and 3.03.D.

D. 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, except those costs and use charges that Article 1.05 assigns to the Owner.
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 (job trailer), complete with necessary furniture, utilities and internet service, and water/sewer service within the job trailer..
4. Its own storage and fabrication sheds.
5. Supplemental heat, ventilation, humidity control and enclosure where these utilities are necessary exclusively for its own activities and are not provided by the General Contractor under Paragraph E.
6. Supplemental temporary heat required above the 60-degree-F minimum provided by the General Contractor, exclusively for its own Work.
7. Each Prime Contractor shall provide all hoisting, lifting, rigging, cranes, forklifts, material-handling equipment, operators, permits, engineering, inspections, and related services required for its Work. No shared hoisting facility is provided unless expressly stated elsewhere in the Contract Documents. Each Prime Contractor shall coordinate hoisting operations, access, staging, and scheduling with the Construction Manager.
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. 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.
12. Separation and disposal of solids prior to release into permanent sewer system.
13. Cleanup and Waste Handling:

    14. Each Prime Contractor shall continuously collect, sort, and transport ordinary construction waste generated by its Work to the common construction dumpsters provided by the Construction Manager. Prime Contractors other than the General Contractor are not required to furnish dumpsters for ordinary construction waste.

15. Each Prime Contractor shall comply with dumpster-use requirements and shall not place hazardous, regulated, liquid, prohibited, or otherwise unacceptable materials in common construction dumpsters.
16. Remove and lawfully dispose of water entering or accumulating in its trenches, excavations, pits, penetrations, equipment pads, work areas, and temporary enclosures, regardless of source, when removal is necessary to perform, protect, or complete its Work.

E. The Contractor for General Construction is responsible for:

17. Temporary facilities and controls not expressly assigned to the Construction Manager or to the Plumbing/Fire Protection, HVAC, or Electrical Contractors.
18. Un-piped sewers and drainage, including drainage ditches, dry wells, stabilization ponds, and containers.
19. Stormwater control.
20. Temporary roads and paving.
21. Temporary enclosure of the building.
22. Temporary partitions.
23. Temporary fire protection and temporary fire extinguishers.
24. Temporary utility service and connections required for temporary HVAC equipment provided by the GC Contract.
25. Temporary heating, ventilation and air conditioning (HVAC) and humidity control from the Notice to Proceed date to when permanent HVAC Systems are to be complete and functioning in accordance with the Project Milestone Schedule for all active phases and areas of the Project.
26. Rodent and pest control.
27. Barricades, warning signs and lights.
28. Site enclosure fences (chain link fence).
29. Site security.
30. Temporary sidewalks and fencing.
31. Security enclosure and lockup.
32. Environmental protection.
33. Site temporary water service, water trucks, and site water systems until new water service is available at the building, as specified in Article 3.03.C.2..
34. Dewatering facilities and drains for all site and building areas until permanent systems are installed, except dewatering for the Work of each Prime Contractor as assigned in Paragraphs D, F, G and H and Article 3.04.C.5.
35. Temporary stairs for construction worker access.
36. Traffic controls.
37. Weekly and as-needed street sweeping as directed by CM due to the accumulation of dirt and debris.
38. 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.
39. Project identification and temporary signs.
40. Control and coordination of fire watch activities.
41. Protection of existing finishes to remain.
42. Snow removal and clearing of the project site to provide access to all construction work areas, construction parking, and staging areas at all times.

43. Snow removal of the temporary lot while construction activities are underway; this item is part of, and does not add to, the snow removal and clearing in Item 26
44. Trimming and clearing of all weeds and grass cutting in the construction site to maintain a clean, organized site at all times.
45. Existing Building Demolition Waste:

    46. The General Contractor shall furnish, maintain, relocate as necessary, haul, and pay all disposal fees for dumpsters and containers required for demolition of the existing building included in the General Contractor's Contract.

47. Existing-building demolition debris shall not be placed in common construction dumpsters provided by the Construction Manager unless specifically authorized by the Construction Manager.
48. Provide Tire wash facilities for use of all prime contractors including all water required.

F. The Plumbing/Fire Protection Contractor is responsible for:

49. Piped temporary water service distribution from the new water service when it is within 5 feet of building.
50. Provide temporary building sewer and stormwater piping within the building footprint and five feet beyond it, including temporary roof-drainage piping from completed roof drains or rainwater leaders to an approved discharge point.3.
51. Temporary fire hoses and signs.
52. Security enclosure and lockup of its own Work areas, in coordination with the General Contractor, who provides project-wide security enclosure and lockup under Paragraph E and Article 3.05.
53. Piped storm water from roof sections as schedule dictates.
54. Plumbing connections to existing systems and temporary facilities and controls furnished by the General Construction, Plumbing/Fire Protection, Mechanical, and Electrical Contracts.

G. The Mechanical Contractor is responsible for:

55. Permanent heating, ventilation and air conditioning (HVAC) from when permanent HVAC Systems are to be complete and functioning in accordance with the Project Milestone Schedule, for each area until after Owner occupancy, including any necessary temporary utility service and connections.
56. Coordination and integration of all new HVAC equipment, components, controls, and associated systems with the existing HVAC infrastructure as required to maintain heating, cooling, ventilation, and occupant comfort in all occupied building spaces throughout the Project. Any HVAC outages or disruptions required to facilitate this Work shall be coordinated with and approved by the Owner and Construction Manager in advance.
57. All labor, materials, equipment, controls, testing, balancing, and commissioning activities necessary to maintain fully operational HVAC service in occupied building areas during all phases of construction.
58. Security enclosure and lockup of its own Work areas, in coordination with the General Contractor, who provides project-wide security enclosure and lockup under Paragraph E and Article 3.05.

E. H. The Electrical Contractor is responsible for:

1. Temporary electric power service and distribution, and temporary service requirements as required with the Construction Manager and the Energy Company.
2. Temporary lighting for building and site.
3. Security enclosure and lockup of its own Work areas, in coordination with the General Contractor, who provides project-wide security enclosure and lockup under Paragraph E and Article 3.05.5. Dewatering and drainage for work under scope.
4. Electrical connections to existing systems and temporary facilities and controls furnished by the General Construction, Plumbing/Fire Protection, Mechanical, and Electrical Contracts.
5. Temporary power distribution and connections specified in Articles 3.03.H.2.e, 3.03.I and 3.03.K, including power for temporary HVAC and dehumidification units and for elevators.
6. Provide and remove temporary power conduit and wire and connections to the CM trailer from the Electrical Contractor's temporary power panel.

1.05 USE CHARGES AND OUTLINE REQUIREMENTS

A. General: Cost or use charges for required temporary facilities shall be included in the total Contract Sum are not chargeable to Owner, Construction Manager, or Architect as extra costs. 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 and Construction Manager (CM).
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 building site. Temporary water distribution after new water service is available at the building is provided by the Plumbing Contractor as specified in Article 3.03.C.3. 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. HVAC System:

7. Until the date identified in the Project Milestone Schedule for the permanent HVAC systems to be complete and functioning, the General Contractor shall furnish, install, operate, maintain, fuel, and remove all temporary HVAC, heating, cooling, ventilation, humidification, and dehumidification equipment required for the Work, except supplemental equipment required exclusively for the Work of another Prime Contractor. All such costs shall be included in the General Contractor's Contract Sum.
8. Beginning on the date identified in the Project Milestone Schedule for the permanent HVAC systems to be complete and functioning, the Mechanical Contractor shall operate and maintain the permanent HVAC systems as required for construction and until turnover to the Owner. The Owner shall pay utility-company metered consumption for approved operation of the permanent HVAC systems.
9. The Mechanical Contractor shall remain responsible for all labor, temporary controls, filters, and Filter media at exterior intakes associated with the construction-period use of the current building’s HVAC systems.
10. 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.
11. If the permanent HVAC system is not complete and functioning by the applicable Project Milestone Schedule date due to the failure or delay of a Prime Contractor, costs resulting from continued temporary HVAC beyond that milestone shall be the responsibility of the Prime Contractor responsible for the delay, subject to the Contract Documents.
12. Mechanical Contractor shall comply with all the requirements of Article 3.03.G.
13. Mechanical Contractor shall provide all controls and safety devices required to operate the permanent HVAC systems during construction, including required fire/smoke monitoring and shutdown functions.

F. 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. Each Prime Contractor shall pay for their communication usage.

1.06 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.

1.07 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.

1.08 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, except that this subparagraph does not change the cost and use-charge assignments in Article 1.05 or the restrictions on use of permanent HVAC systems in Article 3.03.G.

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

2.01 MATERIALS

A. General: Undamaged, previously used materials in serviceable condition may be used if approved by Construction Manager. 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 CM, provide driven posts.
C. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.
D. Water: Potable.

E. Pavement and Concrete: Comply with requirements of Division 03 and 32 Sections.
F. Lumber and Plywood: Comply with requirements of Division 06 Section “Rough Carpentry”.

2.02 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 their required office personnel at the Project site. Wood clad exteriors shall not be permitted.

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.

2.03 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 to be provided by the CM: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Toilet units are to be serviced weekly.
C. 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.

D. Generators: The Electrical Contractor shall verify available utility service before mobilization. If the specified temporary electrical service is unavailable, delayed, or insufficient, the Electrical Contractor shall furnish, install, operate, maintain, fuel, and remove generator capacity and temporary distribution sufficient to meet the requirements of this Section, unless the Contract Documents expressly assign temporary generator service to another entity.
E. 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.
F. 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.
G. 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

3.01 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.

3.02 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.

3.03 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. Sitework 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. This Article applies to sitework sewers and drainage only. Building sewers and drainage, which include the building footprint and the area extending 5 feet beyond it, are provided by the Plumbing/Fire Protection Contractor as stated in Article 1.04.F, except that piping connected to a roof downspout through a rain boot to the sewer pipe is sitework.

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: CM will provide temporary toilets and hand/wash facilities. Facilities shall comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

1. Disposable Supplies: CM to provide toilet tissue, paper towels, hand sanitizer, and similar disposable materials including covered waste containers for disposal of used material.
2. Toilets: Use of Owner's existing toilet facilities will not be permitted. Contractors shall use CM-provided self-contained toilet units.
3. Each Prime Contractor shall provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of its 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 Construction Manager. 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 Construction Manager.

F. Temporary HVAC and Humidity Control: The General Contractor shall provide temporary HVAC and humidity control 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, for each new and renovation building area until permanent HVAC Systems are complete and functioning in accordance with the Project Milestone Schedule. Temporary HVAC and humidity control 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 for construction areas, as stated in Paragraph F.3, and at 70 degrees F for all occupied areas.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 and humidity control to other Prime Contractors when required.
5. The General Contractor shall not be responsible for providing temporary heat and humidity control in permanently unconditioned areas or in areas not scheduled for work, unless the approved construction schedule is modified and accepted by the Owner and all Prime Contractors.

6. Prime Contractors are responsible for protecting their work in unconditioned or unscheduled work areas at no additional expense to the Owner.
7. The Mechanical Contractor shall provide all controls and safety devices required to operate the permanent HVAC systems during construction, including required fire/smoke monitoring and shutdown functions.

G. Existing and Permanent HVAC Systems: Comply with the following:

1. The General Contractor shall provide, maintain and operate sufficient temporary heating/cooling.
2. If the new permanent heating or cooling system is used during the construction period, the Mechanical Contractor shall be responsible to professionally clean all HVAC systems prior to turnover of the building to the Owner.
3. The Mechanical Contractor shall properly protect all existing / permanent HVAC equipment / systems from construction air dust and debris beginning from initial installation.
4. Select safe equipment that will not have a harmful effect on completed installations or elements being installed, and coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy, as required by Paragraphs F.1 and F.2.
14. 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. Utility costs associated with operation of permanent HVAC systems during construction shall be paid in accordance with Article 1.05.E. Construction-period operation of permanent systems shall not relieve the Mechanical Contractor of its responsibility for operation, maintenance, protection, filters, cleaning, servicing, controls, testing, adjustments, or warranty requirements.
7. Portable heaters will not be acceptable during final finishing operations.
8. The existing or new heating and exhaust system or any portion thereof may NOT be used by the General Contractor to provide temporary heat and exhaust.
9. The Mechanical Contractor shall be permitted to use the permanent HVAC system when it is complete and functioning in accordance with the Project Milestone Schedule and 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 Mechanical 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.
10. When the Mechanical 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 Mechanical Contractor shall perform cleaning of duct, coil and other HVAC components necessary to provide clean HVAC systems at Substantial Completion of the Project.
11. Prior to turning over the new permanent heating and ventilating system to the Owner, the Mechanical 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. Contractor shall follow all recommended requirements for cleaning and media as provided in compliance with manufacturer recommendations.

12. 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.
13. 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:

        1) Quantity 15 - Minimum 25 gallons/day capacity (Ebac BD150CR or equal).
        2) Locations shall be as agreed upon in the field with the Architect and Construction Manager.

    d. General Contractor shall furnish and install drainage hoses and connections to discharge condensate to exterior of building at locations acceptable to the Construction Manager 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 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:

      1) Twenty-five (25) 120-volt receptacles
      2) Twenty (20) 240-volt receptacles

   d. Temporary power for construction area.
   e. Ten (10) temporary connections to HVAC temporary heating units when directed by CM.
   f. Temporary site lighting as specified in Article 3.03.L and indicated on the Phasing and/or Site Logistics Plans.

4. 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 terrazzo grinders during floor terrazzo installation. Provide power distribution at multiple locations as required to ensure the grinders can cover the entire terrazzo 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.
8. Provide temporary or permanent power for elevator as follows:
    a. 208/220v 20-amp power at lower lever (pit)
    b. 480V/60A/3 Phase at disconnects at top of elevator shaft

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 and existing buildings where all systems are removed:
    a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
    b. Provide LED temporary lighting. Unless noted otherwise, each “lamp” shall be a minimum of 1600 lumens, either screw-in type or native LED type Where higher lumens are specified, lighting shall be native LED, not screw-in type. Lamps shall be uniformly distributed in all areas requiring temporary lighting to meet the minimum illumination intensity noted for the area or operation as outlined by the Occupational Safety and Health Administration (OSHA) standard for minimum illumination requirements at construction sites (OSHA 29 CFR 1926.56).
    c. Exterior Site Lighting: Provide, install, maintain, relocate as required by construction phasing, and remove temporary exterior site lighting indicated on the Phasing and/or Site Logistics Plans. Provide illumination required for construction operations, security, construction traffic, pedestrian access, and signage visibility.

15. d. Temporary exterior site lights shall be pole mounted, approximately 20 feet high, provide a minimum of 10,000 lumens per fixture, and be controlled by photocells unless indicated otherwise. Locations shown on the Phasing and/or Site Logistics Plans shall be included in the Electrical Contractor's Contract Sum.2. 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.

F. 3.04 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 as long as the facilities are needed. Remove no later than Substantial Completion, as provided in Article 3.06.E. 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 31 20 00 "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. General Contractor shall dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
2. Plumbing Contractor to provide temporary roof-drainage piping after roofing or waterproof deck construction is complete and until the permanent storm-drainage system is connected and operational.
1. 3. General Contractor shall remove snow and ice as required to minimize accumulations.
4.. Remove water from trenches, excavations or other work of each contract by individual Prime Contractors.

D. Waste Disposal Facilities and Cleanup

G. The Construction Manager shall provide common construction dumpsters for ordinary construction waste generated by all Prime Contractors, except for existing-building demolition waste specifically assigned to the General Contractor.
1. Each Prime Contractor shall regularly collect waste generated by its Work and transport such waste to the appropriate common construction dumpster. Each Prime Contractor shall keep its work areas clean and free of accumulated debris.
2. The General Contractor shall provide separate dumpsters and containers required for demolition of the existing building included in the General Contractor's Contract, including hauling and lawful disposal of such demolition debris.
3. Prime Contractors other than the General Contractor are not required to furnish dumpsters for ordinary construction waste generated by their Work.
4. Hazardous, regulated, liquid, prohibited, or other materials not permitted in the common construction dumpsters shall be handled and lawfully disposed of by the Prime Contractor generating or disturbing such material, as required by the Contract Documents.
5. Do not overfill dumpsters or place materials in containers not designated for such materials. The Prime Contractor responsible for improper disposal shall be responsible for resulting sorting, removal, additional hauling, disposal fees, fines, or other associated costs.

H. Coordinate dumpster and container locations, relocation, access, and removal with the Construction Manager.

E. Prime Contractor 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 other facilities as required.

F. Temporary Elevator Use:

1. See Section 14 24 00, Elevators, for temporary use of new elevators.
2. Use of Owner's elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
    a. Do not load elevators beyond their rated weight capacity.
    b. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work, so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

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 CM and 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 Construction Manager and Architect. Do not permit installation of unauthorized signs.
2. Prepare and install up to 10 signs 4' x 3' with information to direct and control traffic on site and in building. Apply graphics and text as directed by Construction Manager. 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 graphics. Adhere custom vinyl graphics after paint has cured. Edge seal vinyl graphics using a fine-tip brush, painting the edges of the film with a commercial grade edge sealer.

3.05 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 CM and 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 Construction Manager, 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 Work Scope 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, Construction Manager, 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 Work Scope 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.

6. For the entire duration of time from the blocking of existing stair towers.
7. For the entire duration of time from the disturbance of the egress route.

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.

3.06 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 that furnished them; facilities furnished by the Construction Manager remain the property of the Construction Manager. 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 017400 "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.

3.07 NO SMOKING

A. Smoking or vaping is not permitted on the entire Project site.

3.08 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, other advertisements, or flags will not be permitted.

3.09 COMPLIANCE WITH TEMPORARY FACILITIES AND CONTROLS

A. If contractor does not comply with any of the requirements of this Section, CM 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 01 50 00

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 -GENERAL

1.1 SUMMARY

A. The Work of this Section Includes: General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
B. Related Requirements:

1. Section 311000 "Site Clearing" for removing existing trees and shrubs and for temporary erosion- and sedimentation-control measures if not specified in Section 015000 "Temporary Facilities and Controls".
2. Section 329600 "Transplanting" for relocating existing trees and plants.

1.2 DEFINITIONS

A. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches above the ground line .
B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches unless otherwise indicated.
D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Erection of sheds or structures.
4. Impoundment of water.
5. Excavation or other digging unless otherwise indicated.
6. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.
D. Take precautions to protect plants from airborne contaminants, such as paint or fireproofing overspray.

PART 2 -PRODUCTS

2.1 MATERIALS

A. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless steel wire ties; and supported by U-shape galvanized-steel posts spaced not more than 96 inches apart.

    a. Height: 48 inches.
    b. Color: High-visibility orange, nonfading.

PART 3 -EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches above the ground.
B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering

operations.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

   1. Posts: Set or drive posts eighteen (18) inches into ground. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
   2. Plastic Fencing: Stretch fabric taut and secure to posts without bows or sags.

B. Maintain protection zones free of weeds and trash.
C. Maintain hydration of plants to assure plant survival.
D. Maintain protection-zone fencing in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

   1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
   2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones in accordance with requirements in Section 312000 "Earth Moving" unless otherwise indicated.
B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

3.5 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as indicated on Drawings.
B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

    1. Prune to remove only broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
    2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
    3. Pruning Standards: Prune trees in accordance with ANSI A300 (Part 1) .

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.
C. Cut branches with sharp pruning instruments; do not break or chop.
D. Do not paint or apply sealants to wounds.
E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.
F. Chip removed branches and dispose of off-site.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a

manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours in accordance with arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain within the limits of disturbance that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period . Remove and replace trees damaged during construction operations, at no cost to the owner, that Architect and/or Arborist determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.
2. Large Trees: Provide two new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.

    a. Species: As selected by Architect.

3. Plant and maintain new trees as specified in Section 329300 "Plants."

END OF SECTION 01 56 39

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SECTION 01 57 23 - TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temporary stormwater pollution controls.

1.2 STORMWATER POLLUTION PREVENTION PLAN

A. The approved NPDES Permit and associated Plans are part of the Contract Documents.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Construction Manager, Engineer, Township Engineer, County Conservation District, and earthwork subcontractor.
2. Review requirements of the NPDES Permit, including permitting process, worker training, and inspection and maintenance requirements.

PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

A. Provide temporary stormwater pollution controls as required by the approved NPDES Permit and associated plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the approved NPDES Permit.
B. Locate stormwater pollution controls in accordance with the approved NPDES Permit.
C. Conduct construction as required to comply with the approved NPDES Permit and that minimize possible contamination or pollution or other undesirable effects.

1. Inspect, repair, and maintain Erosion & Sedimentation (SWPPP) controls during construction.

    a. Inspect all Erosion & Sedimentation (SWPPP) controls not less than every seven days, and after each occurrence of a storm event, as outlined in the approved NPDES Permit.

D. Remove Erosion & Sedimentation (SWPPP) controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION 01 57 23

SECTION 01 60 00 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for selecting products for use in the Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
B. See Division 01 Section "Closeout Procedures" for submitting warranties for contract closeout.
C. See Individual Specification Sections or Construction Drawings for specific requirements for warranties on products and installations specified to be warranted.

1.03 DEFINITIONS

A. Products: Items purchased 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, which is current as of date of the Contract Documents.
    2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
    3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, 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. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other

characteristics for purposes of evaluating comparable products of other named manufacturers.

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.04 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

    a. Specification Section number and title.
    b. Generic name used in the Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date or time span of delivery period.
    h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit (1) copy of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

    a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 60 days after date of commencement of the Work, submit (1) copy of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect/Engineer and/or Construction Manager Action: If necessary, Architect/Engineer and/or Construction Manager will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect/Engineer and/or Construction Manager will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.

B. Pre-bid Substitution Requests: Submit one copy of each Pre-bid Substitution Request not later than 10 days prior to receipt of Bids for consideration. Identify product or

fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Refer to Specification Section 00 43 25, Substitution Request Form.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. List of similar installations for completed projects with project names and addresses and names and addresses of Architects and owners.
    g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
    i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
    j. Cost information, including a proposal of change, if any, in the Contract Sum.
    k. Bidder’s certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    a. Form of Acceptance: Addendum.
    b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated from the information provided it will be rejected.

C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project; product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each Contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect and Owner will determine which products shall be used.
3. The material selected by the Architect shall be provided at no additional cost to the Owner.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions. Deliveries addressed to the project, in general, the Owner, Architect/Engineer, or Construction Manager, will be refused and returned to shipper.

1. Notify Construction Manager and Owner 48 hours in advance of major deliveries.
2. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
3. 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.
4. 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.
5. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
6. Store products to allow for inspection and measurement of quantity or counting of units.
7. Store materials in a manner that will not endanger Project structure.
8. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
9. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
10. Protect stored products from damage.

1.07 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.
B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

    1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
    2. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate form properly executed.
    3. Refer to Individual Specification Sections or Construction Drawings for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that 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 not in conflict with requirements of the Contract Documents.
    4. Where products are accompanied by the term "as selected," Project Engineer will make selection.
    5. Where products are accompanied by the term "match sample," sample to be matched is provided by Architect/Engineer and/or Program Manager.
    6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
    7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures: Procedures for product selection include the following:

    1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
    2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a

product by the manufacturer or from the source named that complies with requirements.

3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
7. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in "Product Substitutions" Article.
8. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product(s)" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Project Engineer's sample. Project Engineer's decision will be final on whether a proposed product matches satisfactorily.
    a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect and Owner will select color, pattern, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect and Owner will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COLOR SELECTION

A. Pre-Selected Colors:

1. Where colors have been specifically identified in the Contract Documents, the products provided by the Contractor shall match the selected color to the satisfaction of the Architect or the product will be rejected as non-conforming materials.
2. Manufacturers listed in the specification sections are capable of manufacturing the product specified but may not manufacture the specific selected color identified in the Contract Documents as part of their running line.

B. If additional up-charges are associated with providing the colors identified in the Contract Documents, the Contractor shall be responsible for all such costs and no additional cost to the Owner above the Contract Sum will be considered.

C. Colors Selected During Construction:

1. Products will be selected by the Architect from the standard colors of any of the listed or approved manufacturers, unless a specific color or color price range has been identified prior to bidding.

D. Location of Selected Colors: In general, preselected colors are identified in the following locations:

1. Exposed Interior Finishes: Room Finish Schedule - Color Legend.
2. Other Materials: Individual Specification Sections or notes to the Drawings.

2.03 SUBSTITUTIONS AFTER EXECUTION OF THE AGREEMENT

A. Substitution of Materials: No substitutions of materials will be considered after the Execution of the Contract without a Credit to the Owner unless a Product becomes unavailable through no fault of the Contractor.

B. NO ACTION TO REVIEW THE PROPOSED SUBSTITUTION WILL BE TAKEN BY THE ARCHITECT OR ENGINEER UNTIL THE CONTRACTOR HAS SUBMITTED THE FOLLOWING:

1. A letter itemizing the proposed credit to Owner.
2. A copy of the warranty.
3. A summary of the schedule impact.
4. Properly executed Document 00 43 25, Substitution Request Form.

C. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request as included above, or when acceptance will require revision to the Contract Documents.

D. In submitting a substitution request the Contractor acknowledges that:

1. The Contractor shall coordinate installation of the substitution including modifications to other Work.

2. The use of this Substitution will not adversely affect the Project Schedule.
3. If modifications to the work of this contract or another contract are required because of the substitution these modifications shall be made at no additional cost to Owner.
4. The Contractor waives all rights to claims for additional costs or time extension which may subsequently become apparent.

2.04 COMPARABLE PRODUCTS

A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
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 Project Engineers and owners, if requested.
5. Samples, if requested.

2.05 USE OF NON-HAZARDOUS MATERIALS:

A. Materials used in this Project shall have no detectable levels of the following hazardous materials.

1. Asbestos of any form or type.
2. Lead in water supply line solder.
3. Lead in paint coatings and finishes.
4. Polychlorinated Biphenyls (PCBs).

B. Upon substantial completion, the Contractor shall submit, on its company letterhead, a signed statement certifying that the products supplied under its Contract had no detectable levels of the hazardous materials listed above in Paragraph 2.5.A. Final payment will not become due until a copy of this letter is submitted.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. General installation of products.
3. Progress cleaning.
4. Starting and adjusting.
5. Protection of installed construction.
6. Correction of the Work.

B. Related Sections include the following:

1. Division 01 Section 01 31 00 "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 01 Section 01 73 29 "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
3. Division 01 Section 01 77 00 "Closeout Procedures".

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, 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, 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.

C. Acceptance of Conditions: 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. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

   a. Description of the Work.
   b. List of detrimental conditions, including substrates.
   c. List of unacceptable installation tolerances.
   d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to 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. 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:

1. Notify Owner not less than 30 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner’s written permission.
3. All utility interruptions shall be scheduled for weekends or holidays.

C. 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.
D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
E. 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. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.03 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. If discrepancies are discovered, notify Architect promptly.

1. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
2. Inform installers of lines and levels to which they must comply.
3. Check the location, level and plumb, of every major element as the Work progresses.
4. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

3.04 INSTALLATION

A. General: 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 the best possible results. 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.
E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels exceeding 80 dBA.
F. 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.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

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.

H. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.05 PROGRESS CLEANING

A. Each Prime Contractor is responsible to comply with progress cleaning. The General Contractor shall be responsible for overall progress cleaning. If in the opinion of the Construction Manager, any contractor fails to comply with progress cleaning, and upon written request by the Construction Manager to the affected contractor, the Construction Manager shall direct the Architect to prepare a deduct change order. The Owner also reserves the right to perform progress cleaning and deduct the cost from the contractor or contractors responsible. If multiple contractors are at fault, the costs may be apportioned solely in the judgment of the Construction Manager. The Construction Manager may also withhold processing of contractor's payment until cleanup duties are resumed to Construction Manager's satisfaction.

B. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. 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 materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

C. Site: Maintain Project site free of waste materials and debris.

D. 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.

E. 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.
F. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
G. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
H. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

I. Waste Disposal: Burying or burning waste materials on site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

J. 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.
K. 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.
L. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.06 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.07 PROTECTION OF INSTALLED CONSTRUCTION

A. When finished work is installed, such as, but not limited to, flooring materials, toilet fixtures, roofing, doors, casework, countertops, finished wall surfaces or other materials that can be damaged during construction, provide appropriate protection immediately after installation to prevent damage.
B. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
C. Comply with manufacturer's written instructions for temperature and relative humidity.

D. Contractors shall not use finished materials and surfaces as ladders, platforms or storage shelves. Tools and toolboxes shall not be placed on finished surfaces without adequate protection.

3.08 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section 01 73 29 "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.
C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

END OF SECTION 01 73 00

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes general administrative and procedural requirements governing execution of the Work.
B. Requirements and limitations for cutting and patching of Work.

1. 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.
2. 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.
3. 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.
4. 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.
5. Contractor, subcontractors, and sub-sub-contractors shall conduct Work in accordance with the Occupational Safety and Health Act of 1970 (OSHA) and all additions, amendments, and revisions thereto.

C. Related Sections include the following:

1. Division 01 Section 01 73 00 “Execution" for additional general administrative and procedural requirements governing execution of the Work.
2. See Individual Specification Sections or Construction Drawings for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

    a. Requirements in this Section apply to plumbing, mechanical, and electrical installations. Refer to Individual Specification Sections for other

requirements and limitations applicable to cutting and patching plumbing, mechanical, and electrical installations.

1.03 DEFINITIONS

A. Cutting: Removal of existing or in-place construction necessary to permit installation or performance of other Work.
B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.04 PREINSTALLATION MEETINGS

A. Cutting and Patching Conferences: Prior to commencing Work requiring cutting and patching, meet at Project site with parties involved in cutting and patching to review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching Work. Inform Architect and Construction Manager of scheduled meeting. Require representatives of each Prime Contract directly concerned or affected by the cutting and patching to attend, including the following:

1. Contractor's superintendent.
2. Trade supervisor responsible for cutting operations.
3. Trade supervisor(s) responsible for patching of each type of substrate.
4. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.

B. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.05 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and structural calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.06 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. 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.

1. Primary operational systems and equipment.
2. Fire separation assemblies.
3. Air or smoke barriers.
4. Fire-protection systems.
5. Plumbing piping systems.
6. Mechanical systems piping and ducts.
7. Control systems.
8. Communication systems.
9. Fire-detection and -alarm systems.
10. Conveying systems.
11. Electrical wiring systems.
12. Operating systems of special construction.

C. Miscellaneous Elements: Do not cut and patch the following elements or related 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.

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Sprayed fire-resistive material.
5. Equipment supports.
6. Piping, ductwork, vessels, and equipment.
7. Noise- and vibration-control elements and systems.

D. 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 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.

1. If 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. Stonework and stone masonry.
c. Ornamental metal.
d. Preformed metal panels.
e. Roofing.
f. Firestopping.
g. Window wall system.
h. Stucco and ornamental plaster.
i. Terrazzo.
j. Finished wood flooring.
k. Wall covering.
l. HVAC enclosures, cabinets, or covers.

1.07 WARRANTY

A. Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void warranties.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.
B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials. Use materials that are not considered hazardous.

PART 3 - EXECUTION

3.01 EXAMINATION

A. 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.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.
B. 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.
C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
D. 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.

3.03 PERFORMANCE

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. 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. Cutting tools or saws shall be equipped with bays or containers, or connected to vacuum systems, to minimize dust.

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: To avoid marring existing 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 a carborundum 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.

C. 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 possible. 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 existing 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, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing 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.

D. 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.

E. 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.

F. 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.

G. 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 “Product Requirements”.

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 Construction Manager and Architect/Engineer, in writing; do not proceed with Work until Architect/Engineer has provided further instructions.

H. Each Prime Contractor shall submit written notice to Construction Manager 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.

I. 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.

J. Each Prime Contractor shall execute Work by avoiding damage to other work and providing proper surfaces to receive patching and finishing.

K. Each Prime Contractor shall execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

L. Each Prime Contractor shall restore Work with new products in accord with requirements of Contract Documents.

M. Each Prime Contractor shall fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

N. Each Prime Contractor shall maintain integrity of wall, ceiling, or floor construction, and completely seal voids.

O. Each Prime Contractor shall refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

P. Each Prime Contractor shall identify hazardous substance or condition exposed during the Work and report to the Construction Manager for decision or remedy.

3.04 HAZARDOUS MATERIAL PROVISIONS

A. Potential for Hazardous Materials that may affect the Work: Certain environmental conditions or hazardous materials may exist or be encountered during the Work. Each Prime Contractor shall follow the guidelines listed below for the environmental conditions listed that may exist or be encountered during the Work.

B. 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 hazardous material or substance, including but not limited to asbestos, mercury, 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, Construction Manager, and Architect of the condition.

1. Lead-Based Paint: Painted and varnished surfaces in buildings built prior to 1978 must be assumed to be coated with lead-based paint. Contractors shall immediately report to Construction Manager any areas suspected to be lead paint for decision or remedy. Contractor shall be responsible for all costs related to removal of lead-based paint items in areas affected by their Work as noted below. All required testing shall be performed in accordance with applicable EPA and HUD standards and guidelines pertaining to lead-based paint inspections.

    a. Lead-Based Paint Disturbance. Each Prime Contractor shall be responsible for lead-based paint disturbance precautions.

        i. For buildings defined as a Child-Occupied Facility (children under the age of 6). When these surfaces are disturbed, that disturbance shall be conducted in accord with the Environmental Protection Agency (EPA) 40 CFR, Part 745 “Lead, Renovation, Repair and Painting Program”. Compliance is to include using EPA licenses and certified trained renovators, Owner and occupant notifications, work area containment, dust minimization, and clean-up certification. Architect/Engineer shall be copied on the Owner and occupant notifications.

        ii. For buildings that are not defined as a Child-Occupied Facility (children under the age of 6), all renovation or new construction work that impacts painted components containing lead shall be performed in accordance with the OSHA Lead-in Construction Standard (29 CFR 1926.62), as applicable to the work being performed; and a proper waste management plan shall be utilized to certify that the waste is tested for hazardous waste classification, as applicable, and properly disposed or recycled. Contractors working on the project are responsible for fulfilling all applicable OSHA requirements pertaining

to lead, as well as all other applicable federal, state, or local requirements or regulations pertaining to lead-in construction.

b. Lead-Based Paint: Demolition and Handling

i. Contractor shall handle, contain, store, test, transport, and dispose of demolition debris with lead-containing surface coating in accordance with applicable local, state, and federal regulations. Most painted architectural components in fair condition (not blistering, peeling, etc.), by law, may be disposed of as Construction and Demolition (C&D) debris. If deemed necessary for disposal, Contractor shall be responsible for collecting and having analyzed representative samples of the waste. If necessary, samples shall be tested for toxicity using the Toxicity Characteristics Leaching Procedure (TCLP) for lead sufficient to determine whether the debris is a hazardous waste as defined in 40 CFR 261.3, or a residual waste, as defined in 25 PA Code 287.1, and shall include such analysis as required by the disposal facility. A qualified environmental laboratory acceptable to the Architect and Construction Manager shall conduct tests. A copy of all testing shall be forwarded to the Architect, Construction Manager and Owner.

ii. The Contractor shall be responsible for the costs of sample collection and laboratory analysis. Alternately, Contractor can assume lead waste generated is a hazardous waste and TCLP testing is not required, but the waste must then be disposed of and transported as hazardous waste.

iii. If, based on testing, there is any hazardous waste generated and transferred to a hazardous waste disposal facility, Contractor shall provide, within 45 days from the time the material is transferred to the disposal facility, a waste manifest to the Owner that identifies the disposal facility name and address, EPA Identification Number, the identity of the waste material, and a statement certifying that the waste was disposed at that facility, including the date. Forward original document to Owner with a copy to the Architect and Construction Manager.

2. Polychlorinated Biphenyl (PCB) Light Ballasts and Mercury-Containing Fluorescent Light Fixture Recycling and Disposal

a. PCB Light ballasts:

i. Ballasts demarcated as non-PCB containing may be recycled as non-PCB ballasts in accordance with applicable industry standards for those types of ballasts.

ii. Ballast that do not carry a demarcation of non-PCB should be assumed to contain PCB’s and recycled as PCB ballasts in a facility that accepts PCB ballasts as universal waste unless they are electronic (no suspect oil). Leaking PCB light ballasts shall be disposed of as hazardous waste unless testing is performed to classify the waste for PCB’s.

b. Fluorescent light tubes should be assumed to contain mercury at levels that could deem them “hazardous waste” for disposal purposes. All fluorescent light

tubes impacted by renovation or new construction work shall be sent for recycling as universal waste to a facility that accepts mercury-containing light tubes as part of their universal waste program.

END OF SECTION 01 73 29

SECTION 01 74 00 – FINAL CLEANING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes final cleaning requirements for the Project.
B. Final cleaning shall be scheduled and completed prior to Owner occupancy for each phase per the Phasing Plan(s).
C. Related Sections include the following:

1. Cleaning Requirements specific to work specified in individual specification sections pertaining to that work.

2. Section 01 12 00 Multiple Work Scope Summary
3. Section 01 50 00 Temporary Facilities and Controls

1.03 QUALIFICATIONS

A. Provide qualified and sufficient personnel responsible for final cleaning of all areas (interior and exterior) impacted by new construction and/or renovation.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Only utilize cleaning materials recommended by manufacturers of product surface to be cleaned.
B. Only utilize cleaning materials on surfaces recommended by the cleaning product material manufacturer.
C. Mico-fiber Towels: New clean microfiber cleaning cloths for damp wiping on all surfaces.

1. Cloths containing cotton or other non-microfiber blends will not be acceptable.

D. Water: Clean, potable water is to be used.
E. Vacuums: All vacuums utilized in final cleaning efforts must be HEPA rated.

1. Vacuums shall be rated as a HEPA unit by the manufacturer and must carry a silver, gold or platinum rating as defined by the Carpet and Rug Institute.

a. Vacuum must be rated at a minimum of 100 inches of water lift.
b. HEPA filters shall be on the vacuum to maintain HEPA rating during use.
c. HEPA filters shall be manufactured for the vacuum being used
d. Conventional vacuum equipment retrofitted with HEPA filters will not be acceptable.
e. Filters shall be maintained and replaced when more than 2/3 full to maintain the vacuum's rated suction lift and dust capture.

PART 3 - EXECUTION

3.01 GENERAL

A. Employ experienced workers or professional cleaners for final cleaning that are trained and qualified in the requirements for the final cleaning.
B. If the personnel employed by the Contractor cannot meet the schedule and cleaning standards established in the Drawings and Specifications, in all or part, the Owner has the right to self-perform and/or hire cleaning crews as required to complete the work. All costs incurred by the Owner will be back-charged to the Contractor.
C. Review requirements for completing final cleaning efforts and conditions that will affect the work.
D. The General Contractor is to provide final cleaning for entire Project except in regards to HVAC equipment and associated ductwork. The Mechanical Contractor is responsible for final cleaning of their equipment and associated filters.
E. The General Contractor shall coordinate cleaning efforts with the work of other Prime Contractors, subcontractors and the Owner.
F. Final Cleaning Coordination Meeting:

1. The General Contractor shall coordinate a final cleaning coordination meeting with the Prime Contractors, Construction Manager, Owner and Owner's other contractors two weeks prior to being on site.

    a. The purpose of this meeting is to establish the phasing of areas to be final cleaned by the General Contractor and review the requirements for the final cleaning and move-in.

2. Contractor shall provide a detailed schedule, including a work plan, respective dates for area and task, quantity of personnel and tasks for the work.

G. At completion of construction and renovation work, and just prior to acceptance or occupancy, conduct a final inspection of exposed interior and exterior surfaces.

1. Perform adjustments and additional cleaning to meet Contract Document requirements.

3.02 EXTERIOR GROUNDS

A. Rake clean grass, gardens, landscaping and other non-pavement surfaces of grounds around the building contaminated by project work or activities.

1. Utilize magnets to remove all screws, nails and other metallic waste debris.
2. Perform a visual survey to remove all non-metallic debris.

B. All bituminous and exterior concrete pavement surfaces and curb and gutter systems shall be broom swept and pressure washed to remove all visible construction-related materials.

1. All driving surfaces must be cleaned by a professional street sweeping company utilizing equipment intended for this type of work. This includes at a minimum bus loops, parking lots and driveways to streets.
2. Remove and dispose of material prior to its discharge into the storm sewer.
3. Once cleaning of all paved areas and curb, gutter systems is complete, and perminate stabilization in accordance with Pa Code 102.22 remove all Storm Water Pollution Prevention Plan (SWPPP) measures to ensure that the site drainage systems function properly.

3.03 BUILDING EXTERIOR

A. Exterior Surfaces

1. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from all exterior surfaces including, but not limited to, window and curtainwall framing/glazing, door systems, metal panel systems, light fixtures and other exposed items.
2. Repair, patch and touch up or replace marred surfaces to match adjacent finishes. Refer to material's corresponding Specification Section for additional information on repair measures.

B. Roof Systems

1. Pick up and remove all visible debris from construction activities including fasteners, insulation, pallets, paper, excess roofing materials and other items from the work.
2. Clean roof drain screens and roof drain bowl assembly to ensure that all debris have been removed and no obstructions exist in the drain assembly.

3.04 BUILDING INTERIOR

A. Clean all rooms from the bottom of the ceiling, or roof deck in areas with exposed ceilings, to the floors and wall surfaces involved in the construction area including:

1. HEPA Vac and wipe down all
    a. Exposed Structures
    b. Mechanical: exposed fire protection piping, hydronic and domestic piping; and ductwork
    c. Electrical: light fixtures
    d. Ceilings: lay-in ceiling grid and tiles; gypsum board soffits and clouds
    e. Wall Surfaces: ceramic or porcelain tile, vinyl wallcovering, painted surfaces

f. Floor Surfaces: terrazzo, VCT, LVT, ceramic or porcelain tile, carpet

B. Clean all exposed interior brick with clean potable water and/or cleaning agent approved for use on brick and interior applications utilizing a scrub brush and changing water every five linear feet of wall to prevent re-contamination of cleaned surfaces.

1. Rinse and remove contaminants
2. Utilize exhaust and ventilation to ensure that areas are dry within 24 hours
3. Utilize procedures to prevent water/cleaning agent damage to all adjacent surfaces

C. Clean all terrazzo with soap clean water and scrubber machine.

1. Clean terrazzo to remove all dirt or cleaning material residue
2. Rinse with clean water until surfaces have no dust or chemical residue and final rinse water is clear.

D. Remove all paint overspray, adhesives, dust contaminants and marks off flooring materials.

1. Double rinse with clan water to remove dust and chemical residue.
2. See each specification section corresponding to flooring materials for specific cleaning and finishing requirements.

E. Completely scrub down all tiled surfaces (i.e. toilet rooms) using clean soapy water and rinse all surfaces with clean water until dust and chemical residue is removed.

1. Prevent water or moisture related damage to the wall systems.

F. HEPA vacuum all floors after all other cleaning activities are complete.

1. Coordinate the work to limit the need for access to the spaces being cleaned.
2. Thoroughly HEPA vacuum carpeting that has been contaminated with dust or debris to remove all those materials from the carpet profile, including the carpet backing surface.
3. If carpet has been stained, the Contractor may try to re-clean the carpet prior to proceeding with removal and replacement. Re-clean carpet that has become stained utilizing techniques recommended by the carpet manufacturer that are gold or platinum rated by the Carpet and Rug institute and that are approved by the Architect/Engineer and that will remove stain and leave the carpet free of chemical residue of contaminants and free of any visible stains or other signs of degradation compared to new condition.
4. Carpet installed in this project needs to be provided and retained in a new condition at the time of project completion.

    a. Remove and replace carpet that is microbial contaminated, is soiled, is visibly stained, is contaminated or otherwise damaged by work or the carpet extraction process or that does not comply with the requirements of the Contract Documents as compared to the carpet in new condition.

G. Replace all damaged, dirty, stained or marred ceiling tile.

H. As applicable, the interiors of all HVAC units shall be completely HEPA vacuumed cleaned and wiped clean with clean micro-fiber cloths to remove all dust residue and other contaminants prior to operation.

1. If HVAC coil surfaces are contaminated with dust, or microbial contaminants, clean to remove the contamination.
2. If liquids or water are utilized to assist with the cleaning, inspect to ensure that the unit surfaces are dry within 24 hours after wetting.
3. Cleaning work shall be performed with utility procedures and materials that will prevent the release or disbursal of any dust or contaminates onto other surfaces in the HVAC system or in the building.

I. The Owner may randomly check interior of air-handling equipment and ductwork.

1. If any visible dust or dirt exists within ductwork, the Contractor shall hire, at their expense, a professional duct cleaning company to clean all affected ducts to remove visible contamination.
2. Cleaning shall occur with 10 days of notification
3. If the required cleaning does not occur, the Owner will have the identified equipment and/or ductwork cleaned and the cost will be deducted from the Contractor’s contract.

J. All mechanical units requiring filters shall have new filters installed after the cleaning process.

1. Filters shall be the type (meeting with depth, size and filter efficiency requirements) specified.

K. Clean all chases in Custodial Rooms, Mechanical Rooms and Toilet Rooms in the area of work.

1. Remove/scrape clean all mortar (without use of acids)/concrete debris, dust and general construction debris.
2. HEPA vacuum clean to remove all dust.

L. HEPA vacuum all the surfaces after all construction is complete.

END OF SECTION 01 74 00

SECTION 01 77 00 – CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY OF SECTION

A. This Section specifies administrative and procedural requirements for the following, but not limited to:

1. Operation, Maintenance and Emergency Manuals
2. Project Record Procedures
3. Closeout procedures

B. Closeout requirements for specific construction activities are included in the appropriate Sections in included Divisions.

1.03 OPERATION AND MAINTENANCE MANUAL CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of respective Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit a draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Agent will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Agent will return copy with comments.

1.04 PREPARATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment including serial numbers.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of a system, list alphabetically in separate list.
D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
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."

1.05 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: 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 Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C Table of Contents: List each product included in the 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. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.

1.06 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. 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.

C. 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.

D. 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.

1.07 OPERATION MANUALS

A. 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 been 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.

B. 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.

C. 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.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

1.08 PRODUCT MAINTENANCE MANUALS

A. 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.

B. 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.

C. 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.

D. 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.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. 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.

1.09 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. 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 warranty and bond information, as described below.

B. 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.

C Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
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.

D Maintenance Procedures: Include the following information and items:

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. training

E 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.

F 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.

G Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H 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.

1.10 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. 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.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

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.

E Manufacturers' Data: Where manuals contain manufacturers' standard printed data, 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.

1. 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.

F. 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 operation and maintenance manuals.
2. Comply with requirements of Owner for newly prepared record Drawings for "Project Record Documents."

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

PART 2 – PROJECT RECORDS

2.01 ADMINISTRATIVE AND PROCEDURAL REQUIREMENTS

A. Administrative and procedural requirements for Project Record Documents.

1. Project Record Documents required include:

a. Marked-up copies of Contract Drawings.
b. Marked-up copies of Shop Drawings.
c. Newly prepared Drawings.
d. Marked-up copies of Specifications, addenda and Change Orders.

e. Marked-up Product Data submittals.
f. Record Samples.
g. Field records for variable and concealed conditions.
h. Record information on Work that is recorded only schematically.

2. Maintenance of Documents and Samples: Store record documents and Samples in the field office apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain record documents in good order, and in a clean, dry, legible condition. Always make documents and Samples available for inspection by the Architect.

2.02 RECORD DRAWINGS

A. Mark-up Procedure: During the construction period, maintain a set of blue-line or black-line white-prints of Contract Drawings and Shop Drawings for Project Record documentation purposes.

1. Mark these Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements which would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:

a. Dimensional changes to the Drawings.
b. Revisions to details shown on the Drawings.
c. Changes made by Change Order.
d. Details not on original Contract Drawings.

2. Mark completely and accurately record on prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
3. Mark record sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.
4. Mark important additional information which was either shown schematically or omitted from original Drawings.
5. Note construction change directive numbers, alternate numbers, Change Order numbers and similar identification.
6. Responsibility for Markup: Where feasible, the individual or entity who obtained record data, whether the individual or entity is the installer, subcontractor, or similar entity, is required to prepare the mark-up on record Drawings.

a. Accurately record information in an understandable Drawing technique.
b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.
c. At time of Substantial Completion, submit record Drawings to Engineer/Architect or Construction Manager for the Engineer/Architect's approval. Upon Engineer/Architect's approval, the Drawings will then become the Owner's records. Organize into sets, bind and label sets for Owner's continued use.

7. Preparation of Transparencies: Immediately prior to inspection for Certification of Substantial Completion, review completed marked-up record Drawings with the

Architect. When authorized, prepare a full set of corrected transparencies of Contract Drawings and Shop Drawings.

a. Incorporate changes and additional information previously marked on print sets. Erase, redraw, and add details and notations where applicable. Identify and date each Drawing; include the printed designation "PROJECT RECORD DRAWINGS" in a prominent location on each Drawing.
b. Refer instances of uncertainty to the Architect for resolution before submitting.
c. One set of original Contract Drawings will be furnished to the Contractor by the Owner for use in recording changes and additional information. Other printing as required is the Contractor's responsibility.
d. The Contractor is responsible for printing original Contract Drawings and other Drawings as required to produce transparencies. The Engineer/Architect will make original Contract Drawings available to the Contractor's print shop.
e. Copies and Distribution: After completing the preparation of transparency record drawings, print two (2) blue-line or black-line prints of each Drawing, whether or not changes and additional information were recorded. Organize the copies into manageable sets. Bind each set with durable paper cover sheets, with appropriate identification, including titles, dates and other information on cover sheets.

    1) Organize and bind original marked-up set of prints that were maintained during the construction period in the same manner.
    2) Organize record transparencies into sets matching the print sets. Place these sets in durable tube-type Drawing containers with end caps. Mark the end cap of each container with suitable identification.
    3) Submit the marked-up record set, transparencies, and two (2) copy sets to the Architect for Owner's records; the Architect will retain one copy set.

2.03 RECORD SPECIFICATIONS

A. During the construction period, maintain one (1) copy of the Project Specifications, including addenda and modifications issued, for Project Record Document purposes.

1. Mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in Specifications and modifications issued. Note related Project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later.

    a. In each Specification Section where products, materials or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.

2. Upon completion of mark-up, submit record Specifications to the Architect for Owner's records.

2.04 RECORD PRODUCT DATA

A. During the construction period, maintain one (1) copy of each Product Data submittal for Project Record Document purposes.

1. Mark Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Product Data submitted. Include significant changes in the product delivered to the site, and changes in manufacturer's instructions and recommendations for installation.
2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
3. Note related Change Orders and mark-up of record Drawings, where applicable.
4. Upon completion of mark-up, submit a complete set of record Product Data to the Architect for the Owner's records.
5. Where record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual, instead of submittal as record Product Data.
6. Each Contractor is responsible for mark-up and submittal of record Product Data for its own Work.

2.05 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer/Architect's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black-line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. See Section 01 30 00 Administrative Requirements for additional information on Record Drawings.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
3. Note related Change Order numbers where applicable.
4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the test of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be

readily discerned later by direct observations. Note related record drawing information and Product Data.

1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records. See Section 01 30 00 Administrative Requirements for additional information on Record Drawings.

D. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Engineer/Architect and/or Construction Manager for the Owner's records. See Section 01 30 00 Administrative Requirements for additional information on Record Drawings.

2.06 2.06MISCELLANEOUS RECORD SUBMITTALS

A. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified, and bound or filed, ready for use and reference. Submit to the Engineer/Architect or Construction Manager for the Owner's records.

1. Categories of requirements resulting in miscellaneous records include, but are not limited to the following:

   a. Field records on excavations and foundations.
   b. Field records on underground construction and similar Work.
   c. Survey showing locations and elevations of underground lines. Invert elevations of drainage piping.
   d. Surveys establishing building lines and levels.
   e. Authorized measurements utilizing unit prices or allowances. Records of plant treatment.
   f. Ambient and substrate condition tests.
   g. Certifications received in lieu of Labels on bulk products. Batch mixing and bulk delivery records.
   h. Testing and qualification of tradesmen.
   i. Documented qualification of installation firms.
   j. Load and performance testing.
   k. Inspections and certifications by governing authorities.
   l. Leakage and water-penetration tests.
   m. Fire resistance and flame spread test results.
   n. Final inspection and correction procedures.

2.07 RECORDING

A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project. The Engineer/Architect and/or Construction Manager will periodically review record documents to assure compliance with this requirement.

PART 3 – COMPLETION AND FINAL CLEANING

3.01 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following: List exceptions in the request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
2. Advise Owner of pending insurance change-over requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
4. Remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

B. Inspection Procedures: On receipt of a request for inspection, the Engineer/Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Engineer/Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Engineer/Architect will repeat inspection when requested and assured that the Work has been substantially completed.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

3.02 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required. Conform to the requirements of Section 01 29 00 - Payment Procedures.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Engineer/Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Engineer/Architect.

4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
5. Submit consent of surety to final payment.
6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Re-inspection Procedure: The Engineer/Architect will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer/Architect.

1. Upon completion of re-inspection, the Engineer/Architect will prepare a certificate of final acceptance or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, re-inspection will be repeated.

3.03 CLOSEOUT SUBMITTALS

A. When the Owner has determined that the Work is acceptable under the Contract Documents and the Contract fully performed, Contractor shall prepare and submit final Application for Payment to the Engineer/Architect together with, but not limited to, the following:

1. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706 (most recent edition of form).
2. Contractor's Affidavit of Release of Liens, AIA Document G706A (most recent edition of form).
3. Contractor's Lien waiver in the full amount of the Contract Sum.
4. Lien waivers from all subcontractors, sub-subcontractors and major material suppliers who have furnished material for the work under the contract with the Trade Contractor or a subcontractor. The lien waivers shall be in the full amount of the contract involved.
5. Consent of Surety Company to Final Payment, AIA Document G707, (most recent edition of form).
6. Evidence of Compliance with requirements of governing authorities:
a. Certificate of Inspection from all required agencies and departments.
b. Certificate of Occupancy.

7. Project Record Documents.
8. Operating and Maintenance Data, Instructions to Owner's Personnel.
9. Warranties and Bonds.
10. Special tools required for Owner maintenance.

3.04 FINAL CLEANING

A. The Contractors shall furnish all labor, materials, tools, equipment, and perform all work and services necessary for cleaning up required in conjunction with work performed, as shown on drawings and as specified, in accordance with provisions of the Contract Documents and completely coordinated with work of all other trades.
B. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
C. Administrative and procedural requirements for final cleaning at Substantial Completion:

1. Special cleaning requirements for specific elements of the Work are included in appropriate Sections of included Divisions.
2. Multiple Prime Contracts: Except as otherwise indicated, each Prime Contractor is responsible for coordination of final cleaning where more than one Prime Contractor is involved in final cleaning a single area or piece of equipment.
3. Environmental Requirements: Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.

    a. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
    b. Burning or burying of debris, rubbish or other waste material on the premises is not permitted.
    c. Cleaning Agents: Use cleaning materials and agents recommended by the 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.

END OF SECTION 01 77 00

SECTION 01 79 00 – DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of all installed systems, subsystems, and equipment.
2. Training in operation and maintenance of all installed systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.03 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. Alternatively, 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.

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, length of instruction time, and instruction date.
D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
E. Provide approved final Operations and Maintenance manuals for use during the training sessions.

1.04 CLOSEOUT SUBMITTALS

A. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
B. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
C. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals AND/OR in PDF electronic file format on a USB flash drive, however Owner prefers

1.05 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, experienced in operation and maintenance procedures and training. Contractor to:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instructions that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

C. Schedule training only after all systems have been tested and are fully operational.

1.06 COORDINATION

A. Coordinate instruction schedule with Owner and Construction Manager. Adjust schedule as required to minimize disruption of 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 has been reviewed and approved by Architect or Construction Manager.

1.07 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 including but not limited to the following:

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.

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. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module(s). Assemble training modules into a training manual organized in coordination with requirements in Section 01 77 00 - "Closeout Procedures"
B. Set up instructional equipment at instruction location.
C. Provide the final training manual, a site-specific agenda, and the resume of the training instructor to the Construction Manager two weeks prior to the scheduled training session.

3.02 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.
C. Owner or Construction Manager will furnish Contractor with names and positions of participants.
D. Scheduling:

    1. Schedule training with Owner, through Construction Manager with at least [seven] (7) days' advance notice, but only after system has been tested and is fully operational.
    2. Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season. The Contractor shall include one initial training and schedule training with Owner, through Architect or CM, with at least fourteen days’ advance notice. Start up and commissioning of systems must be completed before scheduling initial instructional session.
    3. For major systems equipment, the Contractor shall include one (1) follow-up training to address questions or concerns from the Owner after the equipment has been in service for a period of six (6) to twelve (12) months.

E. 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.

F. Review all valve tags, labeling and access locations and provide summary or plans of all valves, shutoffs, and maintenance access locations.

G. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

H. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution of training session in digital format on electronic media provided on a thumb drive.

1. Electronic Media: Read-only digital format in thumb or USB drive format, with commercial-grade graphic label.
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 upon 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 media that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.

c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming, and pause training session. Begin training session again upon commencement of new filming segment.
d. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
e. Narration: Describe scenes on video recording by audio narration by microphone or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
f. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
g. Pre-produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 79 00

SECTION 02 41 16 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Demolition and removal of buildings and structures.
2. Demolition and removal of site improvements adjacent to a building or structure to be demolished.
3. Removing below-grade construction.
4. Disconnecting, capping or sealing, and removing site utilities.

B. Related Sections include the following:

1. Division 01 Section "Summary": Site restrictions.
2. Division 01 Section "Temporary Facilities and Controls": Temporary construction, protection facilities, and environmental-protection measures for building demolition operations.
3. Division 31 Section "Site Clearing": Site clearing and removal of above-grade improvements not part of building demolition.
4. Division 31 Section "Site Clearing": Site stripping, removal of plants and trees, and protection of plants and trees indicated to remain
5. Division 22 and 23 Sections: Demolishing or relocating site plumbing and HVAC items.
6. Division 26 Sections: Demolishing or relocating site electrical items.

1.02 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled.
B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or recycled.

1.03 PERFORMANCE REQUIREMENTS

A. General: 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. Concrete.
b. Concrete reinforcing steel.
c. Brick.
d. Building stone.
e. Concrete masonry units.
f. Structural and miscellaneous steel.
g. Rough hardware.
h. Aluminum windows.
i. Metal studs.
j. Copper and iron piping.
k. Steel supports and hangers.
l. Copper and iron valves.
m. Refrigerants.
n. Electrical conduit.
o. Copper wiring.

1.04 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during building demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
B. Before building demolition, Contractor shall remove and salvage the following items for reinstallation in locations indicated in Drawings:

1. Dedication plaque.

1.05 SUBMITTALS

A. Qualification Data: For demolition firm and refrigerant recovery technician.
B. Proposed Environmental-Protection, Dust-Control, and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
C. Engineering Survey: Submit engineering survey of condition of building.
D. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Locations of temporary protection and means of egress.
5. Coordination of Owner's continuing occupancy of adjacent buildings and partial use of premises.

E. Inventory: After building demolition is complete, submit a list of items that have been removed and salvaged.

F. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by building demolition operations. Submit before Work begins.
G. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
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.

1.06 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
C. Standards: Comply with ANSI A10.6 and NFPA 241.
D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to building demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.

1.07 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of Work.
B. Owner will occupy another building immediately adjacent to demolition area. Conduct building demolition so Owner's operations will not be disrupted.

1. Provide not less than 3 days notice to Owner of activities that will affect Owner's operations.
2. Maintain access to existing walkways, exits, and other adjacent occupied or used facilities.

    a. Do not close or obstruct walkways, exits, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for buildings and structures to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work. Information regarding hazardous materials abatement work performed by Owner under separate contract is provided for reference only as part of Division 00.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

1.08 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Division 31 Section "Earth Moving."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of building demolition required.
B. Review Project Record Documents of existing construction and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents. Available Project Record Documents are available for reference only in Division 00 Section “Existing Conditions Documentation”.
C. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations. Comply with Division 01 Section "Photographic Documentation”.
D. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
E. Verify that utilities have been disconnected and capped before starting demolition operations.

F. When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to Architect.
G. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.02 PREPARATION

A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. Refer to Division 21, 22, 23 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
2. Arrange to shut off indicated utilities with utility companies.
3. If utility services are required to be removed, relocated, or abandoned, before proceeding with building demolition provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
5. Remove refrigerant from air-conditioning equipment before starting demolition.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

C. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.03 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations.
B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during demolition and cleaned and reinstalled in their original locations after demolition operations are complete.
C. Existing Utilities: Maintain utility services indicated to remain and protect them against damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
    a. Provide at least 3 days notice to Owner if shutdown of service is required during changeover.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 1 Section "Temporary Facilities and Controls."

1. Protect existing site improvements, appurtenances, and landscaping to remain.
2. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
6. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise from occupied portions of adjacent buildings.

3.04 DEMOLITION, GENERAL

A. General: Demolish indicated existing buildings, structures and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
2. Maintain adequate ventilation when using cutting torches.
3. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Engineering Surveys: Perform surveys as the Work progresses to detect hazards that may result from building demolition activities.

C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.05 DEMOLITION BY MECHANICAL MEANS

A. Remove buildings, structures and site improvements intact when permitted by authorities having jurisdiction.
B. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
C. Remove debris from elevated portions by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact or dust generation.

D. Below-Grade Construction: Demolish foundation walls and other below-grade construction unless otherwise indicated Abandon below-grade construction only where indicated on Drawings

1. Remove below-grade construction, including basements, foundation walls, and footings, completely unless otherwise indicated.

E. Existing Utilities: Demolish existing utilities and below-grade utility structures unless otherwise indicated.. Abandon utilities only where indicated on Drawings.

1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Division 2 Section "Earthwork."

3.06 EXPLOSIVE DEMOLITION

A. Explosives: Use of explosives is not permitted.
B. Explosives: Perform explosive demolition according to governing regulations.

1. Obtain written permission from authorities having jurisdiction before bringing explosives to, or using explosives on, Project site.
2. Do not damage adjacent structures, property, or site improvements when using explosives.

C. Comply with recommendation in Explosives Consultant's report.

3.07 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Division 2 Section "Earthwork."
C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.08 REPAIRS

A. General: Promptly repair damage to adjacent construction caused by building demolition operations.
B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
C. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

3.09 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

    1. Do not allow demolished materials to 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 demolished materials.
C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.10 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION 02 41 16

SECTION 03 30 00 - 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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
B. Related Requirements:

1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
2. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 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, 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.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
C. 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.
D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

    1. Location of construction joints is subject to approval of the Architect.

E. Contraction Joint Layout: Indicate proposed contraction joint locations.

    1. Location of contraction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer; manufacturer; testing agency.
B. Welding certificates.
C. Material Certificates: For each of the following, signed by manufacturers:

    1. Cementitious materials.
    2. Admixtures.
    3. Form materials and form-release agents.
    4. Steel reinforcement and accessories.
    5. Waterstops.
    6. Curing compounds.
    7. Bonding agents.
    8. Adhesives.
    9. Vapor retarders.
    10. Semirigid joint filler.
    11. Joint-filler strips.
    12. Repair materials.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
E. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

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. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.9 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. 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.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. 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.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

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: 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.

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: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source. Aggregate for door sills and steel pan stairs shall not exceed 1/2inch.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
3. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

F. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

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. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
    b. CETCO; Volclay Waterstop-RX.
    c. Concrete Sealants Inc.; Conseal CS-231.
    d. Greenstreak; Swellstop.
    e. Henry Company, Sealants Division; Hydro-Flex.
    f. JP Specialties, Inc.; Earth Shield Type 20.

2.7 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.

2.8 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. when dry.
C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
D. Water: Potable.
E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class A, certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

    1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. 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.

E. 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.

2.10 CONCRETE MIXTURES, GENERAL

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, according to ACI 301.

1. Use a qualified independent 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 cement in concrete as follows:

1. Fly Ash: 25 percent.
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 according to manufacturer's written instructions.

1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. 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.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings, Foundation Walls and Pit Bottoms: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum W/C Ratio: 0.50.
3. Slump Limit: 4 inches.
4. Air Content: **6** percent, plus or minus 1.0 percent at point of delivery.

B. Concrete Slabs: Normal-weight concrete:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum W/C Ratio: 0.50, except 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.
3. Minimum Cementitious Materials Content: 520 lb/cu. yd.
4. Slump Limit: 4 inches.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 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.

3.2 EMBEDDED ITEM INSTALLATION

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.

3.3 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.

3.4 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.

3.5 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.6 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.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. 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.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- 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-Grade: 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.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "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.

3.8 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.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. 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.

D. 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 operations.

3.10 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 by 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.

3.11 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.

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.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

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 steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 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 ACI 301 for hot-weather protection during curing.
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. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

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 sieve, using only enough water for handling and placing

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, 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 in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. 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. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
    3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

    1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch

wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. 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.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
B. 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.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure one set of five standard cylinder specimens for each composite sample.
    b. Cast and field cure one set of five standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test two specimens (one field and one lab) at 7 days, test six specimens (three field and three lab) at 28 days and two specimens retained in reserve for later testing if required.
    a. Test two field-cured specimens at 7 days and two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

10. 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.
11. Additional Tests: Testing and inspecting agency shall 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. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 to 36 hours of finishing.

END OF SECTION 03 30 00

SECTION 04 20 00 –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 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
2. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
3. Section 076200 "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 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: 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 for each type of exposed unit masonry construction in sizes approximately 72 inches long by 60 inches high by full thickness, including face and backup wythes and accessories. Build mock-up in location as approved by Architect for each type of exposed masonry construction.

        a. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.
        b. Include lower corner of window opening framed with limestone sill at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
        c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
        d. Include metal studs, sheathing, air barrier, insulation, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
        e. The upper one-third of the mockup shall be metal wall panel wall construction. The mockup shall include the transition between masonry and metal wall panel construction.

    2. Clean exposed faces of mockups with masonry cleaner as indicated.
    3. Protect accepted mockups from the elements with weather-resistant membrane.
    4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

        a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.

b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "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 2800 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 Types BR-01 and BR-02 – reference Exterior Legend on Exterior Elevations

2. Grade:

   a. Exterior – SW
   b. Interior – Grade MW or SW may be used.

3. Type: FBS.
4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 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 7-5/8 inches long.
8. Application: Use where brick is exposed unless otherwise indicated.

2.5 STONE TRIM AND WALL CAP UNITS

A. Limestone: Indiana oolitic limestone as quarried in Lawrence, Monroe, and Owen counties, Indiana; complying with ASTM C 568, Category II (medium density); and

matching standards of the Indiana Limestone Institute of America's "Indiana Limestone Handbook" for the following:

1. Grade: Select.
2. Color: Standard Gray
3. Finish: Smooth.

B. Cut stone accurately to shape and dimensions indicated, with exposed faces dressed true, and with beds and joints at right angles to face; comply with fabricating tolerances specified by the Indiana Limestone Institute of America.

1. Stone Masonry Veneer: Provide stone of thickness indicated, but not less than 3-inches plus or minus ¼-inch.

2.6 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 Type III, and hydrated lime complying with ASTM C 207.

1. For pigmented mortar, use a colored cement formulation as required to produce the color indicated or, if not indicated, as selected from manufacturer's standard formulations.

   a. Pigments shall not exceed 10 percent of portland cement by weight for mineral oxides nor 2 percent for carbon black.

2. Basis-of-Design Product: Lehigh Custom Colored Mortar, Light Beige or matching comparable product by one of the following:

   a. Color Mortar Blend; Glen-Gery Corporation.
   b. Rainbow Mortamix Custom Color Cement/Lime; Holcin.
   c. Centurion Colorbond PL; Lafarge Corporation.

D. 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.

E. Aggregate for Grout: ASTM C 404.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. 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. True Tone Mortar Colors; Davis Colors.
b. Centurion Pigments; Lafarge Corporation.
c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.

G. 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.

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units containing integral water repellent. Provide water-repellent by the same manufacturer.

1. Applications: Provide water repellent admixture for mortar in single-wythe exterior concrete masonry walls, in locations where concrete masonry is exposed to weather above grade, and in other locations where masonry units are specified with integral water-repellent.

I. Water: Potable.

2.7 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.

2.8 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.

2.9 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.

2.10 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. 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.

2.11 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.

2.12 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 selection from manufacturer’s range.
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 selection from manufacturer’s range..
2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:

    a. Face brick.
    b. Limestone trim 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. 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.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. 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 071113 "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 079200 "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 20 00

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural-steel materials.
2. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 05.3100 "Steel Decking" for field installation of shear stud connectors through deck.
2. Section 05.5000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame and other steel items not defined as structural steel.
3. Section 09.9113 "Painting" for painting requirements.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.
B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
C. Protected Zone: Structural members or portions of structural members indicated as "protected zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
D. Demand-Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the seismic-load-resisting system and which are indicated as "demand critical" or "seismic critical" on Drawings.

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 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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Slide bearings.
6. Shop primer.
7. Galvanized-steel primer.
8. Etching cleaner.
9. Galvanized repair paint.
10. 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 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. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

D. 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.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, shop-painting applicators, professional engineer and 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.

F. Survey of existing conditions.
G. Source quality-control reports.
H. Field quality-control reports.

1.7 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 ACSE.
C. Shop-Painting Applicator Qualifications: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3.
D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1. Welders and welding operators performing work on bottom-flange, demand-critical welds are to pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G are to be considered separate processes for welding personnel qualification.

1.8 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 F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies 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 and shear walls.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.
B. Channels, Angles, M-Shapes: ASTM A36/A36M.
C. Channels, Angles, S-Shapes: ASTM A36/A36M.
D. Plate and Bar: ASTM A36/A36M.
E. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.
F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, 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/F959M, Type 325-1, compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, 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: Plain.

2.4 RODS

A. Headed Anchor Rods: ASTM F1554, Grade 36, straight.

1. Nuts: ASTM A563 heavy-hex carbon steel.
2. Plate Washers: ASTM A36/A36M carbon steel.
3. Washers: ASTM F436, Type 1, hardened carbon steel.
4. Finish: Plain.

B. Threaded Rods: ASTM A36/A36M.

1. Nuts: ASTM A63 heavy-hex carbon steel.
2. Washers: ASTM F436, Type 1, hardened carbon steel.
3. Finish: Plain.

2.5 SLIDE BEARINGS

A. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.

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. Amscot Structural Products Corp.
b. Fluorocarbon Company Limited.
c. GRM Custom Products.

2. Mating Surfaces: PTFE and PTFE.
3. Coefficient of Friction: Not more than 0.03.
4. Design Load: Not less than 5,000 psi.
5. Total Movement Capability: 2 inches.

2.6 PRIMER

A. Steel Primer:

1. Comply with Section 09.9113 "Painting."
2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.7 SHRINKAGE-RESISTANT GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
B. 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.

2.8 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

    1. Camber structural-steel members where indicated.
    2. Fabricate beams with rolling camber up.
    3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing 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,or punch standard bolt holes perpendicular to metal surfaces.
D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.
F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
G. Welded-Steel Door Frames: Build up welded-steel doorframes attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated on Drawings.
H. 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.

3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.9 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: Pretensioned.

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 ANSI/AISC 303 for mill material.

2.10 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 lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.11 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.
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.
6. Corrosion-resisting (weathering) steel surfaces.
7. 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 2.

C. Surface 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.

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. 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.

2.12 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 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 for stud welding and as follows:

    a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
    b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.

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 on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

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, and Leveling 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. Pretension 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. Slope roof framing members to slopes indicated on Drawings.
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.

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: Pretensioned.

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, 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 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
B. Touchup Painting:

1. 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.

a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Cleaning and touchup painting are specified in Section 09.9113 "Painting."

3.6 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 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.

END OF SECTION 05 12 00

SECTION 05 21 00 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. KCS-type K-series steel joists.
3. K-series steel joist substitutes.
4. LH-series long-span steel joists.

B. Related Requirements:

1. Section 03.3000 "Cast-in-Place Concrete" for installing bearing plates in concrete.
2. Section 04.2000 "Unit Masonry" for installing bearing plates in unit masonry.
3. Section 05.1200 "Structural Steel Framing" for field-welded shear connectors.

1.2 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.3 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.
3. Indicate locations and details of bearing plates to be embedded in other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer amd professional engineer.
B. Welding certificates.
C. Manufacturer certificates.
D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Mill Certificates: For each type of bolt.
F. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
G. Field quality-control reports.

1.5 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 according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.7 SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

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. Canam Buildings US Inc.; Canam Group Inc.
2. New Millennium Building Systems, LLC.
3. Vulcraft/Verco Group; a division of Nucor Corp.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.

1. Use ASD; data are given at service-load level.

2. Design special joists to withstand design loads with live-load deflections no greater than the following:

    a. Floor Joists: Vertical deflection of 1/360 of the span.
    b. Roof Joists: Vertical deflection of 1/360 of the span.

2.3 STEEL JOISTS

A. K-Series Steel Joist: Manufactured steel joists of type indicated according to "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. Joist Type: K-series steel joists and KCS-type K-series steel joists.
2. K-Series Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
3. Provide holes in chord members for connecting and securing other construction to joists.
4. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated on Drawings, complying with SJI's "Specifications."
5. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated on Drawings, complying with SJI's "Specifications."
6. Camber joists according to SJI's "Specifications."
7. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

B. Long-Span Steel Joist: Manufactured steel joists according to "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 follows:

1. Joist Type: LH-series long-span steel joists.
2. End Arrangement: Underslung.
3. Top-Chord Arrangement: Parallel.
4. Provide holes in chord members for connecting and securing other construction to joists.
5. Camber long-span steel joists according to SJI's "Specifications.".
6. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
2. Provide shop primer that complies with Section 09.9113 "Painting."

2.5 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.

B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated on Drawings. Shop prime paint.
C. Steel bearing plates with integral anchorages are specified in Section 05.5000 "Metal Fabrications."
D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.

1. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated on Drawings.
2. Finish: Plain, uncoated.

E. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Plain.

F. Welding Electrodes: Comply with AWS standards.
G. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.
H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.6 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.
D. Shop priming of joists and joist accessories is specified in Section 09.9113 "Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, 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 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 according to 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.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

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.

3.3 REPAIRS

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
B. Touchup Painting:

1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists abutting structural steel, and accessories.

    a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
    b. Apply a compatible primer of same type as primer used on adjacent surfaces.

2. Cleaning and touchup painting are specified in Section 09.9113 "Painting."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Visually inspect field welds according to AWS D1.1/D1.1M.
C. Visually inspect bolted connections.
D. Prepare test and inspection reports.

END OF SECTION 05 21 00

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Acoustical roof deck.
3. Composite floor deck.

B. Related Requirements:

1. Section 03.3000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 05.1200 "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Section 05.5000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.
2. Acoustical roof deck.
3. Composite floor 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. Welding certificates.
B. Product Certificates: For each type of steel deck.
C. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

a. Power-actuated mechanical fasteners.
b. Acoustical roof deck.

2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

E. Qualification Statements: For welding personnel and testing agency.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:

1. AWS D1.1/D1.1M.
2. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
B. 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.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

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. 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. Canam Buildings US Inc.; Canam Group Inc.
2. Epic Metals Corporation.
3. New Millennium Building Systems, LLC.
4. Vulcraft Group; Division of Nucor Corp.

B. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 40, G60 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACOUSTICAL ROOF DECK

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. Canam Buildings US Inc.; Canam Group Inc.
2. Epic Metals Corporation.
3. Vulcraft Group; Division of Nucor Corp.

B. Fabrication of Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 40, G60 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.
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.

9. Acoustical Performance: NRC 0.65, tested in accordance with ASTM C423.

2.4 COMPOSITE FLOOR DECK

1. Canam Buildings US Inc.; Canam Group Inc.

2. Epic Metals Corporation.
3. New Millennium Building Systems, LLC.
4. Vulcraft Group; Division of Nucor Corp.

B. Fabrication of Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI C, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated .
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 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, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI standards for overhang and slab depth.
G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
L. Galvanizing Repair Paint: ASTM A780/A780M.
M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field 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.

3.2 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. Install temporary shoring before placing deck panels if required to meet deflection limitations.
C. Locate deck bundles to prevent overloading of supporting members.
D. 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.

    1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
I. 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.
J. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.3 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 long, and as follows:

    1. Weld Diameter: 5/8 inch, 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 as indicated.
    3. Weld Washers: Install weld washers at each weld location.

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, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and 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. 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. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.

3.4 INSTALLATION OF FLOOR DECK

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, nominal.
2. Weld Spacing:

   a. Weld edge ribs of panels at each support. Space additional welds an average of 16 inches apart, but not more than 18 inches apart.
   b. Space and locate welds as indicated.

3. Weld Washers: Install weld washers at each weld location.

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 36 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.

3.5 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.
2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 09.9113 "Painting."
4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 09.9113 "Painting."

3.6 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 31 00

SECTION 05 40 00 - 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 09.2116 "Gypsum Board Systems" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.

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. Drift clips.
7. Ceiling joist framing.
8. Soffit framing.
9. Post-installed anchors.
10. Power-actuated anchors.
11. Sill sealer gasket.
12. 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 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 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.
2. 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."

E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

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. 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. AllSteel & Gypsum Products, Inc.
2. ClarkDietrich.
3. Marino\WARE.
4. Steel Network, Inc. (The).

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01.4000 "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.
   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 1/240 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 of 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 ASTM C955 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.

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: 0.0428 inch.
2. Flange Width: 1-3/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch and matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips, Exterior: Manufacturer's standard bypass or 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. AllSteel & Gypsum Products, Inc.
b. ClarkDietrich.
c. Marino\WARE.
d. Simpson Strong-Tie Co., Inc.
e. Steel Network, Inc. (The).

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.

2.5 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: 0.0329 inch.
2. Flange Width: 1-3/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch and matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips, Interior: Manufacturer's standard bypass or 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. AllSteel & Gypsum Products, Inc.
b. ClarkDietrich.
c. Marino\WARE.
d. Simpson Strong-Tie Co., Inc.

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 AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

    1. Uses: Securing cold-formed steel framing to structure.
    2. Type: Torque-controlled adhesive anchor or adhesive anchor.
    3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
    4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

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, multimonomer, nonleaching plastic; 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.

2.11 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 NONLOADBEARING 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: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb 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 bypassing or 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 NONLOADBEARING 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: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb 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 and as follows:

1. 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.

3.7 REPAIR

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 40 00

SECTION 05 50 00 - 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. Loose steel lintels.
2. Manufactured downspout boots.
3. Miscellaneous steel trim.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete fill.
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 Railings" for metal handrails and railings.
5. Division 6 Section "Rough Carpentry" plywood backing panels for sheet metal fabrications.
6. Division 9 Section "Painting and Finishing" painting requirements for exposed metal fabrications.
7. Divisions 15 and 16 for miscellaneous supports of hangers for equipment, pipes, etc.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Division 1 Section "Submittals."
B. 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.

C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
D. Welding Certificates: Copies of certificates for welding procedures and personnel.
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 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.

1.5 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.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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.

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 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.

2.4 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: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.5 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.

2.6 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.

2.7 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.

2.8 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.
C. Galvanize miscellaneous framing and supports where indicated.

2.9 MANUFACTURED DOWNSPOUT BOOTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Piedmont Pipe Manufacturing, Model B1 Downspout Boot or comparable product by another manufacturer.
B. Boots:

1. Material: ASTM A240 Type 304 stainless steel, 0.1094 inch thick.
2. Finish: Manufacturer’s standard UV resistant powder coat.
3. Color: As selected by Architect from manufacturer’s full range.

2.10 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.

2.11 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.

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.

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 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 50 00

SECTION 05 51 00 – 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 3 Section “Cast-In-Place Concrete” for concrete fill for stair treads and platform.
2. Division 5 Section “Metal Fabrications” for pipe and tube railings.
3. Division 9 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 Toprails: 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.

2.1 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 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.

2.2 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 subtreads 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.

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation.

2.4 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.

2.5 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

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.

END OF SECTION 05 51 00

SECTION 05 52 13 - 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. Galvanized steel handrails for exterior applications.
2. 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 exterior stairs with metal railings.
2. Division 9 Section “Painting and Finishing” Field painting shop primed railings

1.3 PERFORMANCE REQUIREMENTS

A. 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

B. Structural Performance: Provide railings 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.

C. 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 Change (Range): 120 def F, ambient, 180 def F, material surfaces.

D. Control of Corrosion : Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 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.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Railing brackets.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other Work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

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 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 METALS

A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.
B. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:

1. Pipe: ASTM A 53/A 53M, Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
2. Steel Tubing: Cold-formed steel tubing, ASTM A 500, Grade A, unless another grade is required by structural loads.
3. Steel Plates, Shapes, and Bars: ASTM A 36.
4. Iron Castings: Malleable iron complying with ASTM A 47, Grade 32510; or gray iron complying with ASTM A 48, Class 30.

C. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
D. 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.

2.2 WELDING MATERIALS, FASTENERS, AND ANCHORS

A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners for Anchoring Handrails and Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.

1. For steel handrails, railings, and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

C. Fasteners for Interconnecting Handrail and Railing Components: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, unless otherwise indicated.

D. Cast-in-Place and Post installed Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials 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. Cast-in-place anchors.
2. Epoxy adhesive anchors.
   a. Products: Subject to compliance with requirements, provide Hilti HVA System; or comparable product by Rawl.

2.3 PAINT

A. Shop Primers: Provide primers that are compatible with coatings specified in Division 09 Section "Painting and Coating."

B. 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.

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.

2.4 GROUT AND ANCHORING CEMENT

A. No shrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, no shrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. 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 use.

2.5 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 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. 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.
G. 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.
H. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.
I. 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.
J. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

K. 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.
L. Fabricate joints that will be exposed to weather in a watertight manner.
M. Close exposed ends of handrail and railing members with prefabricated end fittings.
N. 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.

2.6 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.

2.7 STEEL FINISHES

A. 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.
B. For galvanized handrails and railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
C. 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.
D. 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."

E. 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.
    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.
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: 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. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's written instructions:

1. Nonshrink, nonmetallic grout or anchoring cement.

B. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8-inch buildup, sloped away from post.

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 stainless-steel railings, weld flanges to post and bolt to metal supporting surfaces.
2. For steel 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. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface, post or other obstruction.
B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads but not less than 48 inches o.c.
C. Secure wall brackets 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 adhesive epoxy anchors.
3. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

3.6 ADJUSTING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.
C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
D. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.
E. 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.

END OF SECTION 05 52 13

SECTION 06 10 00- ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Wood blocking and nailers.
4. Wood furring.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certification: Documentation provided by Manufacturer, certifying that the iron and steel products, Manufactured Products, and Construction Materials provided meet the domestic preference requirements of the Build America, Buy America Act (BABAA) mandated by Title IX of the Infrastructure Investment and Jobs Act ("IIJA"), Pub. L. 177-58.
B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
C. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Engineered wood products.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

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

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that 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.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, blocking, and similar concealed members in contact with masonry or concrete.

3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.

1. Application: as indicated on drawings.
2. Species:

    a. Mixed southern pine; SPIB.
    b. Northern species; NLGA.
    c. Eastern softwoods; NeLMA.

B. Framing Other Than Non-Load-Bearing Interior Partitions: No. 2 grade.

1. Application: Framing other than interior partitions.
2. Species:

    a. Hem-fir (north); NLGA.
    b. Southern pine; SPIB.
    c. Douglas fir-larch; WCLIB or WWPA.
    d. Spruce-pine-fir; NLGA.

2.4 ENGINEERED WOOD PRODUCTS

A. Engineered Wood Products, General: Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

1. Extreme Fiber Stress in Bending, Edgewise: As indicated on the Drawings.
2. Modulus of Elasticity, Edgewise: As indicated on the Drawings.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

2. Nailers.
3. Cants.
4. Furring.
5. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed 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.

2.6 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, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: NES NER-272.

C. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.7 METAL FRAMING ANCHORS

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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.

C. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.
B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. 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 furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
E. Do not splice structural members between supports unless otherwise indicated.
F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

3.2 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 rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

3.3 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.
B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION 06 10 00

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof sheathing.
2. Sheathing as part of a composite wall panel system as noted in drawings.

B. Related Requirements:

1. Division 06 "Rough Carpentry" for plywood backing panels.
2. Division 07 "Fluid-Applied Air Barrier Membrane" for air barriers applied to wall sheathing.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.3 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 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: DOC PS 1.
B. Oriented Strand Board: DOC PS 2.
C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
D. Factory mark panels to indicate compliance with applicable standard.

2.2 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.

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.

C. Fire-Retardant-Treated Exterior Grade Plywood Wall Sheathing.

    a. Not less than 5/8” thickness.
    b. Span rating: Not less than 16/0

2. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities have jurisdiction and with fire-test response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
3. 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.\

    a. Use treatment that does not promote corrosion of metal fasteners.
    b. 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 D 2898. Use for exterior locations and where 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.

    a. Span ratings after treatment shall be not less than span ratings specified.

2.3 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: NES NER-272.
D. Wood Screws: ASE B18.6.1.
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.

F. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: 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. Provide washers or plates if recommended by sheathing manufacturer.

2.4 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”.

2.5 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. 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.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. 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 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. 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.

3.3 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.

3.4 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.

END OF SECTION 06 16 00

SECTION 06 40 23 - 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. Wood nosings and trim for stage platform and steps.
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. Circulation desks.
3. Custom recessed display cases with glass doors, glass shelves, and shelf standards.
4. Flush wood veneer panels for room signage
5. Shop finishing interior woodwork.
6. Solid surface window sills, and stools.

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 and Coating": Field finishing of architectural woodwork not indicated for shop finish.
5. Division 12 Section "Manufactured Laminate-Clad Casework":
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. 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. Fabric and core material for tackboard panels.
4. 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 successful in-service performance.

C. 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.

D. Fire-Test-Response Characteristics: Provide FRP column covers that comply with the following:

1. Surface-Burning Characteristics: Class 1 per ASTM E 84, Flame Spread less than 25 unfilled, without use of fillers or antimony trioxide.
2. Smoke Density: Under 450.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 PRODUCT 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 and relative humidity at occupancy levels 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.

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.

PART 2 - PRODUCTS

2.1 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: Select white birch plain sawn or sliced.

C. Wood Species for Opaque Finish: Yellow poplar or closed-grain white hardwoods.
D. Wood Products: Comply with the following:

1. Medium-Density Fiberboard: ANSI A208.2, Grade MD; Exterior Grade where indicated.
2. Particleboard: ANSI A208.1, Grade M-2; M-2-Exterior Glue for laminate clad aprons and access panels at lavatory counters and where indicated.
3. Softwood Plywood: DOC PS 1, Exterior.
4. Hardwood Plywood and Face Veneers: HPVA HP-1.

E. Thermoset Decorative Overlay (Melamine): Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

1. Manufacturer: As indicated in Finish Legend on the Drawings.

G. Adhesive for Bonding Plastic Laminate: Urea-formaldehyde or Resorcinol.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

H. 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.
I. 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.

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.

2.2 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.

2.3 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. 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 and Rails: 1/16 inch.

D. 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.

E. 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.

F. 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.

2.4 INTERIOR WOOD TRIM AND WOODWORK FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 300 for standing and running trim.
B. In locations indicated, use veneered construction or hardwood plywood. Provide face veneers of type and species indicated for transparent finished woodwork, with hardwood edge banding on exposed edges.
C. 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.

2.5 DISPLAY CASES

A. Quality Standard: Comply with AWI Section 300.
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: [White powder coat.] [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.

2.6 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.

2.7 SOLID SURFACE WINDOW STOOLS

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 solid surface cladding on horizontal surfaces.
E. Core Material: Medium-density fiberboard, exterior grade.

2.8 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: None required.
3. Staining: Match approved sample for color.
4. Sheen: Satin, 30-50 gloss units.
5. 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. 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.

H. 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 40 23

SECTION 07 10 00 – DAMPPROOFING AND WATERPROOFING

PART 1– GENERAL

1.1 SECTION INCLUDES

A. Fluid-applied dampproofing.
B. Fluid-applied waterproofing.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete
B. Section 04 20 00 - Unit Masonry.

1.3 REFERENCES

A. ASTM International (ASTM):

1. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
2. ASTM D412 - Tests for Rubber Properties in Tension
3. ASTM D1187 - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
4. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
5. ASTM D4479 - Standard Specification for Asphalt Roof Coatings - Asbestos-Free.
6. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
7. ASTM E96 - Water Vapor Transmission of Materials.

B. Federal Specifications:

1. MIL-R-3472 Roof Coating, Asphalt Base Emulsion.
2. SS-A-694 Asphalt Roof Coating (Brushing & Spraying Consist).
3. SS-C-153 - Cement, Bituminous, Plastic.
4. SS-R-1781 - Roof-Coating, Asphalt-Base Emulsion.
5. SS-W-110 - Water-Repellent Colorless, Silicone Resin Base.

C. National Standard of Canada 37.58 - M86.

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. Warranty: Submit a sample warranty identifying the terms and conditions stated in Warranty article.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Applicator shall be experienced in applying the same or similar materials.
B. Regulatory Requirements: Comply with applicable codes, regulations, ordinances, and laws regarding use and application of products that contain volatile organic compounds (VOC).

1.6 PRE-INSTALLATION MEETINGS

A. Pre-Installation Conference: Prior to beginning work, convene a conference to review conditions, installation procedures, schedules and coordination with other work.
B. Convene minimum two weeks prior to starting work of this section.

1.7 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.

1.8 PROJECT CONDITIONS

A. Do not apply when surface temperature or weather conditions conflict with manufacturer's published requirements.
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.

1.9 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 WARRANTY

A. Warranty: Provide manufacturer's standard limited material warranty.

PART 2– PRODUCTS

2.1 MANUFACTURERS

A. Acceptable 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. Carlisle Coatings & Waterproofing, Inc.
6. Henry Company.
7. Tamko Building Products, Inc.

B. Requests for substitutions will be considered in accordance with Division 01 provisions as established by Construction Manager.

2.2 DAMPPROOFING

A. Non-Fibered Emulsion Dampproofing: Brush or spray applied, general purpose coating. Manufactured with refined asphalt, emulsifiers and selected clay fillers.

1. Dries to a tough, flexible, durable finish and will resist extreme variations in temperature and weather.
2. Low odor coating.
3. May be applied to damp surfaces.
4. ASTM D1227, Type III.
5. ASTM D1187, Type II.
6. SS-R-1781.
7. MIL-R-3472A.
8. Coverage Rate: 2 to 3 gallons per 100 square feet.
9. Solids by Weight: 54 to 58 percent, nominal.
10. Solids by Volume: 56 to 60 percent, nominal.

11. Color: Black.
12. Permeance: 0.5 perms.
13. Cure Time: 24 to 48 hours at 77 degrees F and 50 percent Relative Humidity.
14. Service Temperature (Cured Film): -40 to 180 degrees F.
15. Reference: 100AF by KARNAK Corporation.
16. Fabric Reinforcing: Reference: Karnak #31 Fiber Glass Membrane.

2.3 WATERPROOFING

A. Single component, elastomeric waterproofing membrane, polyurethane with bitumen modifiers.

1. Single Layer Dry Film Thickness: 60 mils.
2. Prime Coat as recommended by Manufacturer.
3. ASTM C836.
4. Complies with National Standard of Canada 37.58 - M86.
5. Coverage Rate: 4 gallons per 100 square feet.
6. Shore Hardness, ASTM C836: 85.
7. Elongation, ASTM D412: 600 percent.
8. Tensile Strength, ASTM D412: 50 PSI.
9. Water Vapor Permeance, ASTM E96: 0.1 perm.
10. Heat Aging, ASTM C836: No Cracking.
11. Crack Bridging, ASTM C836: Pass (10 cycles).
12. Adhesion, ASTM C836: 5 lbs/in.
13. Solids: Minimum 90 percent.
14. Color: Black.
15. Reference: 192 One-Kote by KARNAK Corporation.

PART 3– EXECUTION

3.1 EXAMINATION

A. Before work is started, applicator shall thoroughly examine all surfaces for any deficiencies.
B. Notify Architect in writing of any defects.

3.2 SURFACE PREPARATION

A. Surface should be free of oil, grease, dirt, laitance and loose material.
B. Repair all cracks and holes as recommended by Manufacturer, before applying surface coating.

3.3 APPLICATION

A. Comply with manufacturer recommendations and approved submittals. Mix as recommended by manufacturer.
B. For fabric reinforced applications, apply first coat. Apply reinforcing fabric over the wet coating, overlapping all edges. Smooth out all wrinkles, to ensure there is no trapped air beneath fabric. Apply second coat.

END OF SECTION 07 10 00

SECTION 07 21 00 - 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
7. Glass-faced polyiso insulation behind metal panels

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 07 Section "Metal Wall Panels": Structural metal wall panels siding applied with metal building type insulation.
6. Division 09 Section "Gypsum Board Assemblies": Sound attenuation insulation installed as part of metal-framed wall and partition assemblies.

1.3 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.

1.4 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.

1.5 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.

1.6 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Extruded-Polystyrene Board Insulation:

a. DiversiFoam Products.
b. Dow Chemical Company.
c. Owens Corning.
d. Pactiv Building Products.

2. Glass-Fiber Insulation:

a. CertainTeed Corporation.
b. Johns Manville Corporation.
c. Knauf Fiber Glass.
d. Owens Corning.

3. Spray Polyurethane Foam Insulation:

a. BASF Corporation.
b. Dow Chemical Company.
c. Henry Company.

4. Expanding Foam Sealant:

a. Dow Chemical Company.
b. Geocel Corporation.
c. Macklanburg-Duncan; GE Sealants & Adhesives.
d. Tytan Products.

5. Glass-Faced Polyiso Insulation:

a. Henry Company
b. Siplast
c. Atlas

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Sustainability Requirements: Provide glass-fiber board insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

C. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:

1. Type IV, 25 psi.
    a. Applications: Use for foundation walls, under-slab conditions, and with Z-furring at perimeter walls.

D. Extruded-Polystyrene Board Insulation: Provide coated glass faced polyiso foam plastic insulation boards 2 ½" thickness;

1. R Value – 15.3
2. ASTM C 1289 Type II, Class 2
    a. Applications: Behind exterior metal wall panel system.

2.3 SPRAY FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

2.4 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.

2.5 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. 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. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

C. Install blanket insulation in cavities formed by framing members according to the following requirements:

1. Use blanket 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 blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

D. Install board insulation on sheet steel substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Slip board into "Z" retainer at bottom, ensuring that free clearance is maintained at bottom of board.
2. Fasten insulation anchors to sheet steel substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation beyond indicated thickness.
4. Seal joints in vapor barrier with tape.

3.5 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.

3.6 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.

3.7 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.

3.8 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 21 00

SECTION 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS

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. Fluid-applied membrane air barrier, vapor permeable applied to sheathing over metal studs.

B. Related Sections include the following:

1. Division 07 Section “Composite Wall Panels.”
2. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

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 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.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.

B. 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.
C. Qualification Data: For Applicator.
D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.

    1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
    2. Include junction with roofing membrane.
    3. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
    4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site.

    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.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages 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 rolls according to manufacturer's written instructions.
D. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 FLUID-APPLIED MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Synthetic polymer membrane.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Synthetic Polymer Membrane:

1) Henry Company; Air-Bloc 31 or 33.
2) Sto Corp.
3) Prosoco R

2. Physical and Performance Properties:

a. Membrane Air Permeance: Not to exceed 0.004 cfm/ sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
b. Membrane Vapor Permeance: Not less than 21 perms; ASTM E 96.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.
C. Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, crosslaminated polyethylene film with release liner backing for use with metal flashings.
D. Butyl Strip: Vapor-retarding, 30- to 40-mil- thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing for use with EPDM or TPO membranes.
E. Modified Bituminous Strip: Vapor-retarding, 40-mil- thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing for use with compatible roofing membranes.
F. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.
G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
H. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

I. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

J. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

K. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil- thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance of 37 perms.

L. Joint Sealant and Mastic: Provide sealant type specified below or another type compatible with and recommended by membrane manufacturer for type of exposure. Mastics shall be compatible with membrane and be recommended by membrane manufacturer.

1. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 07 Section "Joint Sealants."

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. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Mask off adjoining surfaces not covered by air barrier 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 and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.
E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install butyl or modified bituminous strip as appropriate, on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing

and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials as indicated.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip or adhesive-coated transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

    1. Modified Bituminous and Adhesive-Coated Transition Strip: Roll firmly to enhance adhesion.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
I. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, modified bituminous strip.
J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.5 AIR BARRIER MEMBRANE INSTALLATION

A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
C. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours or not covered in the same day.

    1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

D. Apply a continuous unbroken air barrier to substrates to achieve the manufacturer’s recommended minimum dry film thickness. Apply membrane in full contact around protrusions such as masonry ties.
E. Apply strip and transition strip over cured air membrane overlapping 3 inches onto each surface according to air barrier manufacturer's written instructions.

F. Do not cover air barrier until it has been inspected by Owner's Representative or Architect.
G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.
H. When required by manufacturer, immediately install insulation over membrane air barrier according to manufacturer’s instructions.

3.6 CLEANING AND 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 07 27 26

SECTION 07 41 13 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Field-assembled, standing-seam metal roof panels for straight application and field seamed joints.
2. Flashing and sheet metal fabrications incidental to roof panel systems, including gutters and downspouts.
3. Seam-mounted, continuous snow guard systems.

B. Related Sections include the following:

1. Division 05 Section "Steel Decking": Steel roof deck supporting metal roof panels.
2. Division 05 Section "Metal Fabrications": Metal downspout boots.
3. Division 06 Section "Sheathing": Roof nailable composite insulation panels for roof deck.
4. Division 07 Section "Metal Flashing and Trim": Flashings and other sheet metal work not part of metal roof panel assemblies.
5. Division 07 Section "Roof Specialties": Copings, gutters, downspouts and counterflashings not part of metal roof panel assemblies.
6. Division 07 Section "Joint Sealants": Field-applied sealants not otherwise specified in this Section.

1.2 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, and accessories necessary for a complete weathertight roofing system.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.
B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 283 at the test-pressure difference of 1.57 lbf/sq. ft.
C. Water Penetration: No water penetration when tested according to ASTM E 331 at test-pressure difference of 2.86 lbf/sq. ft.

D. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in

FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail Resistance: MH.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift resistance Class 90.

F. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330 for straight roofs. [ASTM E 1592 for curved roofs and ASTM E 330 for straight roofs] <330 is typical; 1592 w/ Zip-Rib >

1. Loads: Determine wind loads and snow loads by calculations based on load criteria indicated on Drawings.

G. Thermal Movements: Provide metal roof panel assemblies 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, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel, insulation and accessory.

B. Shop Drawings: Show fabrication and installation layouts of insulation and metal roof panels; method of installation and attachment of insulation; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work. Shop drawings shall show layout of snow guards as approved by snow guard manufacturer.

1. Insulation Attachment: Show compliance with requirements.
2. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
    a. Flashing and trim.
    b. Curved rake trim.
    c. Gutters.
    d. Downspouts.
    e. Snow guards.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, seam caps, closures, and other metal roof panel accessories.
2. Accessories: 12-inch-long Samples for each type of accessory.

D. Qualification Data: For Installer.
E. Field quality-control inspection reports.
F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:

1. Metal Roof Panels: Include reports for air infiltration, water penetration, and structural performance.

G. Maintenance Data: For metal roof panels to include in maintenance manuals.
H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. Installer's responsibilities include fabricating and installing metal roof panel assemblies.

B. Source Limitations: Obtain each type of metal roof panels through one source from a single manufacturer.
C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative, deck Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
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 roof panel installation, including manufacturer's written instructions.
4. Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of deck during and after roofing.
6. Review requirements for roof insulation.
7. Review flashings, special roof details, roof drainage, roof penetrations, equipment supports, snow guard installation and condition of other construction that will affect metal roof panels.
8. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.

9. Review temporary protection requirements for metal roof panel assembly during and after installation.

D. 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 mockups for typical roof area only, including accessories.

a. Size: 12 feet long by 6 feet.
b. Each type of exposed seam and seam termination.

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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PRODUCT HANDLING

A. Deliver components, sheets, metal roof panels, insulation panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.
C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.
D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate metal panel roof assemblies with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal roof panel assemblies 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, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two 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 roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer 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 from date of Substantial Completion.

C. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for non-structural metal roof panels is based on FIELD-LOK Standing Seam Panel, Model1-1/2” FLM-165; ATAS International Inc., Allentown PA, (610-395-8445, www.atas.com). Subject to compliance with requirements, provide the basis-of-design product or comparable product by one of the following:

1. Berridge Manufacturing Company.
2. Innovative Metals Company, Inc. (IMETCO).
3. Petersen Aluminum Corporation.

2.2 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alclad alloy 3003, 3004, or 3105, with temper as required to suit forming operations and structural performance required.

1. Surface: Smooth, flat
2. Exposed Finish: High-performance organic 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 and resin manufacturers' written instructions.
    a. Fluoropolymer Two-Coat 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.
3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant for Exposed Joints: ASTM C 920; silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Sealant for Concealed Joints: Butyl-rubber-based, solvent-release sealant; ASTM C 1311.
4. All standing seams to be sealed with facorty sealant.

2.3 INSULATION FOR METAL ROOF PANELS

A. Refer to Section 061600 "Sheathing."

2.4 UNDERLAYMENT MATERIALS

A. General: Provide underlayment materials recommended by metal roof panel manufacturer for conditions of installation, selected from those specified in this Article.
B. Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.

2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
3. Subject to compliance with requirements, provide one of the following:
4. .; CCW WIP 300HT.
5. .; Ultra.
6. ; Blueskin PE200 HT.
7. ; MetShield.
8. ; WeatherLock Metal High Temperature Underlayment.

C. Slip Sheet: Building paper, minimum 5 lb/100 sq. ft., rosin sized; unless otherwise recommended by roof panel manufacturer.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.

1. Fasteners for Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
3. Blind Fasteners: High-strength stainless-steel rivets.

B. 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.

2.6 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be field assembled by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Field-Formed Panels: Panel lengths that exceed maximum shipping lengths may be field rolled on equipment furnished by panel manufacturer that will produce panels identical to factory manufactured products.

   a. Provide equipment with no fewer than 12 rolling stations.
   b. Operate equipment by factory trained full time experienced technician.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging

opposite edge of adjacent panels, and mechanically seaming panels together. Provide factory-applied sealant in all seams.

1. Material: Aluminum Sheet: .040.
    a. Exterior Finish: Fluoropolymer.
    b. Color: As selected by Architect from manufacturer's full range
2. Clips: Floating to accommodate thermal movement.
    a. Material: 0.0250-inch-thick, stainless-steel sheet.
3. Nominal Panel Coverage16 1/2 inches.
4. Nominal Seam Height for Straight Roof: 1-1/2 inches

2.7 ACCESSORIES

A. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Clips: Minimum 0.0625-inch-thick, stainless-steel panel clips designed to withstand negative-load requirements.
3. Cleats: Mechanically seamed cleats formed from minimum 0.0250-inch-thick, stainless-steel sheet.
4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material and thickness as roof panels. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

1. Curved Rake Trim: Factory formed from sheet metal to curvature of radius roof, lengths subject to approval of Architect.
    a. Provide continuous neoprene foam closure to produce a compression seal at flashing.

C. Gutters and Downspouts: Provide gutters and downspouts in shapes and sizes indicated, and with expansion joints in locations indicated.

1. Fabricate gutters and downspouts with mitered and welded corners. Do not use exposed rivets.
2. Include concealed brackets, hangers or other attachment devices; end plates; and trim and other accessories indicated or required for complete installation.

a. Furnish gutter supports spaced no more than 32 inches o.c., fabricated from same metal as gutters. Align strap anchors with standing seam of metal roof.

3. Expansion Joints: Butt type, with concealed splice plates.

a. Cover splice plates at interior of gutters with self adhesive EPDM tape, completely covering joint. Seal edges of tape with compatible sealer.

4. Valley Baffles: Provide sheet metal baffles, 6 inches high with 18 inch long legs, located at outside edge of gutter at bottom of roof valleys, to keep water from overshooting gutter during heavy rains.
5. Fabricate gutters and downspouts in minimum 96-inch-long sections, of the following metal:

a. Aluminum; 0.050 inch thick.
b. Prepainted, Metallic-Coated Steel; 0.0336 inch thick (20 gage).

6. Finish gutters and downspouts to match metal roof panels, unless otherwise indicated.

D. Splash Blocks: Precast concrete, 2500 psi minimum, with smooth finish; style as selected by Architect from standard patterns available.

1. Provide splash block at grade discharge of each downspout.

E. Snow Guards: Prefabricated, noncorrosive units designed to be installed without penetrating metal roof panels, and complete with predrilled holes, clamps, or hooks for anchoring.

1. Seam-Mounted, Continuous Snow Guards: Aluminum snow fence held in place by aluminum clamps attached to vertical ribs of standing-seam metal roof panels, with color insert using metal roof panel material.

a. Basis of Design Product: S-5! ColorGard.
b. Aluminum Finish: Powder Coat Enamel.

2.8 FABRICATION

A. General: Fabricate and finish metal roof 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. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
C. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the 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: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

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 and painted 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.

    1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
B. Install flashings and other sheet metal to comply with requirements specified in Division 07 Section "Metal Flashing and Trim."

3.3 INSULATION INSTALLATION

A. Board Insulation: Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 07 Section "Thermal Insulation."

    1. Use multiple layers of insulation as necessary to conform to roof curve.

3.4 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment; Full Cover: Install self-adhering sheet underlayment, wrinkle free, on roof sheathingunder metal roof panels. Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply at entire area indicated for metal roof panels and as indicated below, in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.

    1. Roof to wall intersections for a distance from wall of 18 inches.
    2. Around penetrating elements for a distance from element of 18 inches.

B. In windy conditions or where underlayment does not properly adhere to nailable substrate, nail perimeter of underlayment membrane with roofing or cap nails at intervals of 12 inches o.c. Do not use staples.

    1. In moderate or high wind conditions, provide additional nailing in field of membrane.
    2. As an alternative to nailing, apply surface conditioner to roof deck at coverage rate recommended by underlayment manufacturer. Allow surface conditioner to dry thoroughly before walking on substrate, since it is slippery when wet.
    3. Cover underlayment with exposed roofing material as soon as possible.

C. Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Metal Flashing and Trim."
D. Apply slip sheet over underlayment before installing metal roof panels.

3.5 METAL ROOF PANEL INSTALLATION, GENERAL

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other

components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal roof panels by torch is not permitted.
2. Rigidly fasten eave end of metal roof panels and allow free movement of panels due to thermal expansion and contraction. Predrill panels.
3. Provide metal closures at perimeter conditions.
4. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

3.6 FIELD-ASSEMBLED METAL ROOF PANEL INSTALLATION

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to substrate with fasteners recommended by roof panel manufacturer, and at recommended spacing but not less than 24 inches o.c.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

3.7 ACCESSORY INSTALLATION

A. General: 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 roof panel assembly including trim, closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. 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 will be permanently watertight and weather resistant.

1. Install exposed flashing and trim 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.
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 or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 32 inches o.c. aligned with standing seams using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building, unless otherwise indicated.
2. Tie downspouts to underground drainage system where downspouts terminate at grade.

E. Continuous Snow Guards: Attach bar supports to vertical ribs of standing-seam metal roof panels with set screws. Do not use fasteners that will penetrate metal roof panels.

1. Provide snow guards at not less than the locations indicated on Drawings. Provide additional snow guards as recommended by manufacturer and applicable industry standards, in quantities and locations to prevent snow and ice from sliding off roof, as approved by Architect. Obtain snow guard manufacturer’s approval of snow guard layout and include on shop drawings.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4113

SECTION 07 42 43 - COMPOSITE METAL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Metal-faced composite material panels for walls, soffits, fascia, and other applications indicated.
2. Supplemental framing and furring supporting metal panels.
3. Concealed fasteners and anchorage hardware for composite metal panels.

B. Related Sections include the following:

1. Division 04 Section “Unit Masonry”: Exterior wall assembly mock-up requirements.
2. Division 05 Section "Cold-Formed Metal Framing": Framing supporting metal panels.
3. Division 07 Section “Self-Adhering Sheet Waterproofing”: Weather barrier behind metal composite material panels at vented soffit/fascia conditions.
4. Division 07 Section "Metal Wall Panels": Concealed fastener, lap seam metal wall panels.
5. Division 07 Section "Metal Flashing and Trim": Flashings and other sheet metal work not part of metal panel assemblies.
6. Division 07 Section "Joint Sealants": Field-applied sealants not otherwise specified in this Section.

1.2 DEFINITION

A. Metal Panel Assembly: Metal panels, attachment system components, miscellaneous metal framing and furring, and accessories necessary for a complete weathertight system.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide metal panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft.
C. Water Penetration: No water penetration 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 lbf/sq. ft. and not more than 12 lbf/sq. ft.
D. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:

1. Loads: Determine wind loads and snow loads by calculations based on load criteria indicated on Drawings.
2. Deflection Limits: Engineer metal panel assemblies to withstand test pressures with deflection no greater than 1/180 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span.

    a. Test Pressure: Wind-load design pressure as indicated on Drawings.

E. Thermal Movements: Provide metal panel assemblies 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, ambient; 180 deg F, material surfaces.

F. Fire Propagation Characteristics: Composite metal panel system passes NFPA 285 testing.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal panel and accessory.
B. Shop Drawings: Show fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of flashing and trim items, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes and for sealant.
D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.
2. Sealant: Sealant applied to panels of each color selected.

E. Qualification Data: For Installer.
F. Product Test Reports: For each product, tests performed by a qualified testing agency demonstrating metal composite material panel assembly passes NFPA 285 Intermediate-Scale Multistory Fire Test.
G. Maintenance Data: For metal panels to include in maintenance manuals.
H. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
B. Source Limitations: Obtain each type of metal panel through one source from a single manufacturer.
C. Mockups: Build mockups of exterior wall assemblies as specified in Division 04 Section “Unit Masonry”.

1.7 PRODUCT HANDLING

A. Deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
D. Protect strippable protective covering on metal panels from exposure to sunlight and high humidity, except to extent necessary for period of metal panel installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel assemblies 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, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two 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 panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer 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 from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Subject to compliance with requirements, provide the following:

1. Metal-Faced Composite Panels: "Omega Lite" composite panels with "1-Piece, Tight-Fit Molding" installation accessories; Laminators Inc., Hatfield, PA.

B. Comparable Manufacturers: Subject to compliance with requirements, provide the basis-of-design product or comparable product by one of the following:

1. ATAS international Inc.

2.2 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy 3003, 3004, or 3105 for painted**]** finishes, with temper as required to suit forming operations and structural performance required.

1. Surface: Smooth, flat finish.

2. Exposed Finishes: Apply the following coating, as specified or indicated on Drawings.

   a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      1) Fluoropolymer Two-Coat 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.

3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

B. Thickness: 0.236 inch (6mm)
C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated.
D. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.3 MISCELLANEOUS METAL FRAMING

A. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G60, hot-dip galvanized zinc coating.
B. Cold-Rolled Furring Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch-wide flange.
C. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide concealed fasteners unless otherwise indicated.

1. Fasteners for Metal Panels: Stainless steel screws and aluminum wire clips specifically designed for concealed connection of composite panels to substrate, and to be concealed within panel joint by trim or sealant; as detailed in approved shop drawings.

2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. 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.

2.5 METAL PANELS

A. Metal Composite Material Panels (MP-01): Factory-formed panels with core material, metal face sheet and metal backing.

1. Panel Facing: Prefinished aluminum sheet, not less than 0.032 inch thick.
2. Panel Backing Sheet: Aluminum, 0.001 inch thick; mill finish.
3. Core Material: Corrugated polyallomer plastic engineered by manufacturer to meet performance requirements when laminated with specified face material.
4. Overall Composite Panel Thickness: 1/4 inch.
5. Dimensional tolerance: Plus or minus 1/16 inch in all directions, including diagonally.
6. Exterior Finish: Fluoropolymer.
    a. Color: As selected by Architect from manufacturer's full range.

2.6 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal panel assembly including trim, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Molding Intersection: Vertical Pass-Through Joint with H-Molding

B. Flashing and Trim: Formed from metal of type and finish matching adjacent metal panels, not less than 0.0179-inch-thick. Provide flashing and trim 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, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

C. Aluminum Trim Accessories: Manufactured from extruded aluminum with factory-applied colored coating or clear anodized finish, as indicated.

1. Reveal Moldings: Extruded aluminum moldings of types indicated.
    a. Soffit Vent: 3-inch wide by 3/4 inch deep vented soffit; Fry Reglet Vented Soffit Molding No. SV-75-V-300.

2. Finish: High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Fluoropolymer Two-Coat 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.
    b. Color: Custom color to match adjacent metal composite material soffit panels.

2.7 FABRICATION

A. Field measurements of site conditions shall be coordinated with approved Shop Drawings prior to beginning installation of the BD&V sub-framing for locations of intermediate adhesive supports, joints, and edge locations.
B. Install BD&V sub-framing according to written instructions and drawings supplied by the ACM Panel System Manufacturer. Field-coordinate placement of BD&V sub-framing relative to substrate prior to placement of joints.
C. Field-coordinate placement of joints relative to BD&V sub-framing prior to field-fabrication of panels.
D. Field-fabricate panels to sizes and joint configurations indicated on approved Shop Drawings.
E. Fabricate panels with sharply cut edges and no displacement of face or backer sheets or protrusion of core. Form panel angles, breaks, corners, lines, and returns to be sharp, true, and free of buckle and/or warp.
F. Fabrication Tolerances:

    1. Width: +/- 1/16 inch
    2. Length: +/- 1/16 inch
    3. Squareness: +/- 1/16 inch

G. Panel Installation:

    1. Install the BD&V ACM Panel System plumb, level, and true in compliance with Manufacturer’s recommendations and approved Shop Drawings.
    2. Comply with the BD&V ACM Panel System Manufacturer’s instructions for installation of concealed fasteners; provisions of Section 079200; and manufacturer’s recommendations for installation of joint sealants.
    3. Installation Tolerances:

        a. Adjacent vertical or horizontal panel out-of-plane offset: +/- 1/16 inch
        b. Panel edge shall not be exposed short of the finished face of molding.
        c. Adjacent vertical or horizontal panel edge alignment: +/- 1/16 inch
        d. Adjacent vertical or horizontal joint intersection deviation: +/- 1/16 inch
        e. Maximum vertical or horizontal joint intersection deviation: 1/4 inch in any 20 feet

    4. Do not cut, trim, weld, or braze BD&V ACM Panel System-specific components during installation in a manner which would damage the finish, decrease strength, or result in visual imperfection or a failure in performance.

5. Separate contact of dissimilar metals with approved methods as defined by the Manufacturer in order to eliminate the possibility of corrosive or electrolytic action between metals.

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. Protect mechanical and painted 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of 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 panel manufacturer.
2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to metal panels, including removing projections capable of interfering with attachment.
B. Miscellaneous Framing: Install furring and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal panel manufacturer's written recommendations.

1. Soffit Framing: Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL PANEL INSTALLATION

A. General: Install metal composite material panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, 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. Field cutting of metal panels by torch is not permitted.
2. Shim or otherwise plumb substrates receiving metal panels.
3. Flash and seal metal panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal panels are installed.
4. Install screw fasteners in predrilled holes.
5. Install flashing and trim as metal 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. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal panel manufacturer.

1. Coat back side of wall panels with bituminous coating where wall panels will contact wood, ferrous metal, or cementitious construction.

C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

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 1-Piece, Tigh-Fit Molding System of metal composite material wall panels to supports at locations, spacings, and with fasteners per manufacturer's written instructions to achieve performance requirements specified.

3.4 ACCESSORY INSTALLATION

A. General: 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 panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. 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 will be permanently watertight and weather resistant.

1. Install exposed flashing and trim 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.
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 or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

A. Installation Tolerances, Composite Metal Panels: Shim and align metal panel units within installed tolerance of 1/16 inch in 10 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/16-inch offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 43

SECTION 07 53 23 - EPDM ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Fully adhered ethylene-propylene-diene-monomer (EPDM) membrane roofing system.
2. Roof insulation.
3. Pipe flashings and other roof penetrations flashings.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry": Wood nailers, curbs, and blocking; and plywood roof deck panels.
2. Division 07 Section "Metal Flashing and Trim": Metal roof penetration flashings and base flashings.
3. Division 07 Section “Preparation for Reroofing” removing existing roofing and preparing substrates for new roofing.
4. Division 07 Section "Metal Flashing and Trim": Metal roof penetration flashings and base flashings.
5. Division 07 Section "Manufactured Roof Specialties": Manufactured reglets and counterflashing.
6. Division 22 and 23 Sections: Roof drains and equipment curbs.

1.2 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, 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 membrane manufacturer based on testing and field experience.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Insulation fastening patterns.

C. Samples for Verification: For the following products:

1. Roofing Membrane: 12-by-12-inch square of sheet in color specified, including T-shaped side and end lap seam.
2. Insulation: 12-by-12-inch square.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of meeting performance requirements.

F. Qualification Data: For Installer and manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

H. Research/Evaluation Reports: For components of membrane roofing system.

I. Maintenance Data: For roofing system to include in maintenance manuals.

J. Warranties: Special warranties specified in this Section.

K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Manufacturer Qualifications: A qualified manufacturer that has FMG approval for membrane roofing system identical to that used for this Project.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

1. For roof moisture testing, operator of roof moisture test apparatus shall have not less than 3 years experience performing the type of inspections indicated.

D. Source Limitations: Obtain components for membrane roofing system approved by roofing membrane manufacturer.

E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. For roof-expansion joints, provide fire-barrier assemblies with fire-test-response characteristics not less than that of adjacent construction, as determined by testing identical products per UL 2079 and ASTM E 119, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Assemblies shall be capable of anticipated movement while maintaining fire rating. Identify assemblies with appropriate markings of applicable testing and inspecting agency.

F. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck 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 deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

G. Roof Installation Monitoring: Arrange for roofing system manufacturer's technical representative or qualified independent inspection agency acceptable to Owner to monitor roofing installation.

1. Manufacturer's representative shall monitor roofing installation no fewer than 2 days for every 5 days of roofing activity, for not less than 2 hours per day.
2. Manufacturer's representative shall submit report to Architect noting any deviations from project requirements or manufacturer's installation standards.

1.6 PRODUCT 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, 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.

1.7 PROJECT 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.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

    1. Special warranty includes roofing system from roof edge to edge including roof terminations and coping; roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover boards, substrate board, expansion assemblies, roof penetrations, walkway products, and other components of membrane roofing system.
    2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof terminations and coping, roof insulation, fasteners, cover boards, substrate boards, and walkway products, for the following warranty period:

    1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM ROOFING MEMBRANE

A. EPDM Roofing Membrane: ASTM D 4637, Type II, scrim or fabric internally reinforced uniform, flexible sheet made from EPDM, and as follows:

1. Basis-of-Design Product: The design for EPDM membrane roofing is based on Sure-Tough EPDM Reinforced Membranes by Carlisle Syntec Systems. Subject to compliance with requirements, provide the named product or comparable product by one of the following:

a. Firestone Building Products Company.
b. GenFlex Roofing Systems.
c. Johns Manville International, Inc.

2. Thickness: 60 mils nominal.
3. Exposed Face Color: Black.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.
C. Supplemental Membrane for Overlay: Manufacturer's standard unreinforced EPDM sheet flashing, 60 mils thick, of same color as primary membrane and without fleece backing.
D. Bonding Adhesive: Manufacturer's standard bonding adhesive.
E. Cold Fluid-Applied Membrane Adhesive: Manufacturer's standard cold fluid-applied bonding adhesive formulated to adhere fleece-backed roofing membrane to substrate.
F. Seaming Material: Manufacturer's standard primer and 6-inch-wide minimum, splice tape with release film.
G. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.
H. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
I. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
J. Pipe Penetration Seals: Preformed, self-flashing pipe seals for roof penetrations, consisting of membrane compatible with roofing and flashing materials, with stainless steel compression clamps.
K. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

L. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from insulation manufacturer's standard sizes, suitable for application, and of thicknesses indicated.

1. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated, not less than two times the roof slope.

B. Roof Insulation: Provide roof insulation product in thicknesses indicated in Part 3 as follows:

1. Board Insulation, Polyisocyanurate: CFC- and HCFC- free, with recycled content glass-fiber mat facer on both major surfaces, ASTM C1289 Type II Class 1.

a. Basis of design product: Carlise, InsulBase Insulation.
b. Compressive Strength, ASTM D1621: Grade 2: 20 psi (138 kPa).
c. Conditioned Thermal Resistance at 75 deg. F (24 deg. C): 14.4 at 2.5 inches (50.8 mm) thick.

2.4 ROOF INSULATION ACCESSORIES

A. Cover Board:

1. Gypsum panel, glass-mat-faced, ASTM C1177/C1177M.

a. Basis of design product: Carlisle, SecurShield HD Polyiso Insulation.
b. Thickness: 1/4 inch (6 mm).

B. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.
C. Insulation Fasteners: Factory-coated steel fasteners and metal or plastic 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains 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 surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Deck."
4. 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 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. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
D. Install acoustical roof deck rib insulation strips, specified in Division 5 Section "Steel Deck," according to acoustical roof deck manufacturer's written instructions.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
C. Install tapered insulation under area of roofing to conform to slopes indicated and to provide positive slope to drain.
D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. and allow primer to dry.
2. Set each layer of insulation in a cold fluid-applied adhesive.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together and fasten to roof deck.

1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.

3.4 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
D. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
G. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
H. Repair tears, voids, and lapped seams in roofing that does not meet requirements.
I. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
J. Install roofing membrane and auxiliary materials to tie in to existing roofing.

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane 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 bonding adhesive 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.

3.6 MANUFACTURED ROOF SPECIALTY INSTALLATION

A. General: Comply with manufacturer's written installation instructions and in accordance with Section 07 7100.

3.7 FIELD QUALITY CONTROL

A. Roof Moisture Testing: Owner will engage a qualified independent testing and inspecting agency to perform roof moisture tests and to mark areas of completed roofing where moisture is indicated by testing.

1. Moisture Survey: Testing and inspecting agency will perform an infrared video inspection of entire roof area to identify moist areas.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

1. Repair components of roofing system damaged by testing and inspection procedures. Comply with requirements of roofing system manufacturer for cutting and patching roofing, and the following:

a. Coordinate repair work with activities of testing and inspection agency so repairs are performed on same day that roof probes or test cuts are made.
b. Apply supplemental roofing membrane sheet to cover area of repairs and test probes, using sheet not less than 8 inches wider than area of repair, with rounded corner.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing systems after completion of installation and repairs, and submit report to Architect.

1. Notify Architect or Owner 3 days in advance of date and time of inspection.

3.8 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing 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 membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane 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.

3.9 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <Insert name of Owner.>
2. Address: <Insert address.>
3. Building Name/Type: <Insert information.>
4. Address: <Insert address.>
5. Area of Work: <Insert information.>
6. Acceptance Date: <Insert date.>
7. Warranty Period: <Insert time.>
8. Expiration Date: <Insert date.>

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
    a. lightning;
    b. peak gust wind speed exceeding 55 mph;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost

and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature.>
2. Name: <Insert name.>
3. Title: <Insert title.>

END OF SECTION 07 53 23

SECTION 07 62 00 - METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sheet metal flashing and trim in the following categories:

1. Formed roof drainage systems including scuppers, conductor heads, gutters and downspouts.
2. Sheet metal cladding applied over plywood substrate for fascia and other conditions indicated.
3. Formed metal base flashing, roof flashing, and counterflashing.
4. Copper date stone box liner.
5. Miscellaneous sheet metal trim and brake metal not specified as part of other assemblies.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete": Installing reglets in concrete.
2. Division 04 Section "Unit Masonry": Through-wall flashing and other integral masonry flashings specified as part of masonry work; and brick surround for circular openings, where custom-formed radiused flashings are required.
3. Division 05 Section "Metal Fabrications": Metal downspout boots.
4. Division 06 Section "Rough Carpentry": Wood nailers, curbs, and blocking; and plywood backing for sheet metal cladding.
5. Division 07 Section "Metal Roof Panels": Factory-formed metal roof panels and flashing and trim not part of sheet metal flashing and trim.
6. Division 07 Section "Metal Wall Panels": Factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
7. Division 07 Section "EPDM Roofing": Installing sheet metal flashing and trim integral with roofing membrane.
8. Division 07 Section "Roof Specialties": Manufactured sheet metal components including Copings, fascia, roof edges, gutters, downspouts, reglets and counterflashings.
9. Division 07 Section "Roof Accessories": .
10. Division 07 Section "Joint Sealants": Elastomeric sealants.
11. Division 07 Section "Expansion Control": Manufactured metal expansion-joint covers.

1.2 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, rattling, leaking, and fastener disengagement.

B. 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. Based 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.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples: For sheet metal flashing, trim, and accessory items, in the specified finish. Include Sample sets composed of 2 or more units showing the full range of variations expected.

1. Sheet Metal: 8-inch-square Samples of specified sheet materials to be exposed as finished surfaces.
2. Trim and Accessories: 12-inch-long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.

D. 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.

1.4 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 Architecture 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.

1.5 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.

1.6 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. High-Performance Organic 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 and resin manufacturers' written instructions.

    a. Fluoropolymer 2-Coat System: 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; complying with AAMA 2605.
    b. Colors: As indicated on Drawings, or if not indicated, as selected by Architect from manufacturer’s full range.
    c. Applications: Sheet metal fabrications exposed to view in the completed work, in locations adjacent to metal products with a factory-painted finish.

2. Anodized Finish: Apply the following coil-anodized finish:

    a. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

b. Applications: As follows:

1) Aluminum flashing and trim in locations adjacent to metal products with a clear anodized finish.

B. Stainless-Steel Sheet: ASTM A 240, Type 304; No. 2D (dull, cold rolled) finish.
C. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.
D. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

2.2 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.
B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

2.3 MISCELLANEOUS MATERIALS

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. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
D. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
E. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
F. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
G. 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.
H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
I. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
J. 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.

K. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

1. Provide splash block at discharge of each downspout Where indicated on Drawings.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where 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. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.5 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.

1. Material: Stainless Steel; 0.0250 inch thick.

C. Flashing and Trim Material: Aluminum; 0.050 inch thick.

1. Applications: Step flashing, drip edges, base flashing and counterflashing; and cladding applied over plywood substrate for fascia and other applications indicated.
2. Finish for Flashing and Trim Exposed to View: Factory-applied colored coating, high-performance organic finish.
3. Finish for Concealed Flashing: Clear anodized.

D. Opening Flashing in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high end dams.

1. Material: Aluminum; 0.050 inch thick.

E. Drip Edges: Aluminum; 0.050 inch thick.
F. Eave and Rake Flashing: Aluminum; 0.050 inch thick.

G. Step Flashing: Stainless Steel; 0.0250 inch thick.

1. Finish: Prepared and field painted as specified in Division 09 Section "Painting and Coating."

H. Base Flashing: As follows:

1. Stainless steel, 0.0250 inch thick; for flashing in contact with concrete or masonry.
2. Aluminum, 0.050 inch thick; for flashing not in contact with concrete or masonry.

I. Flashing Receivers: As follows:

1. Stainless steel, 0.0250 inch thick; for flashing receivers in contact with concrete or masonry.
2. Aluminum, 0.050 inch thick; for flashing receivers not in contact with concrete or masonry.

J. Roof-Drain Flashing: Lead; 4.0 lb/sq. ft., hard tempered.
K. Equipment Support Flashing: Stainless Steel; 0.0250 inch thick.
L. Roof-Penetration Flashing: Stainless Steel; 0.0250 inch thick.
M. Date Stone Box Liner: Copper; 16 oz./sq. ft.

2.6 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 and painted 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.

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.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. 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 fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum, stainless-steel and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. 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 or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Aluminum: Use aluminum or stainless-steel fasteners.
2. Copper: Use copper or stainless-steel fasteners.
3. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with butyl sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

I. 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.

1. Do not solder aluminum sheet.
2. Pretinning is not required for lead sheet.
3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
4. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
5. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

K. Roof Drainage System Installation: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

1. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

L. Roof Flashing Installation: Install sheet metal roof flashing and trim to comply with performance requirements, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

1. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant.
    a. Secure in a waterproof manner by means of anchor and washer at 36-inch centers.

2. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
    a. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
    b. Seal with butyl sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

M. Wall Flashing Installation: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

1. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Section "Unit Masonry."
2. Reglets: Installation of reglets is specified in Division 03 Section "Cast-in-Place Concrete." / 04 Section "Unit Masonry."
3. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
D. 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 71 00 - MANUFACTURED ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Gravel stops.
2. Gutters and downspouts other than those specified as part of metal roof panel systems.
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 "Metal Roof Panels": Gutters and downspouts incidental to roof panel systems.
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 Fascia and Gravel Stops:
    a. Architectural Products Co.
    b. ATAS International, Inc.
    c. W.P. Hickman Co.
    d. Metal-Era, Inc.
    e. MM Systems Corp.
    f. Southern Aluminum Finishing Co.

2. Formed-Aluminum Gutters and Downspouts:
    a. Architectural Products Co.
    b. ATAS International, Inc.
    c. W.P. Hickman Co.
    d. 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 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.

2.4 GUTTERS AND DOWNSPOUTS

A. Provide gutters and downspouts in shapes and sizes indicated, and with expansion joints in locations indicated.

1. Fabricate gutters and downspouts with mitered and welded corners. Do not use exposed rivets.
2. Include concealed brackets, hangers or other attachment devices; end plates; and trim and other accessories indicated or required for complete installation.
3. Valley Baffles: Provide sheet metal baffles, 6 inches high with 18 inch long legs, located at outside edge of gutter at bottom of roof valleys, to keep water from overshooting gutter during heavy rains.
4. Expansion Joints: Butt type, with concealed splice plates.
    a. Cover splice plates at interior of gutters with self adhesive EPDM tape, completely covering joint. Seal edges of tape with compatible sealer.

B. Additional Features: Provide items below fabricated from the same metal as gutters and downspouts.

1. Downspout starters (fascia sump) with downspout starter hole.
2. Flow-through gravel stop with perforated vertical leg.
3. Downspout elbows, preformed and welded, size and configuration to suit conditions.

C. Provide gutters and downspouts fabricated from formed-aluminum sheet not less than 0.050 inch thick.

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 counterflashing 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. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet o.c. using manufacturer's

standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

F. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building, unless otherwise indicated.
2. Tie downspouts to underground drainage system where downspouts terminate at grade.

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 71 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

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. Walls and partitions.

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 aenclosures.
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 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.

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.

1.5 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.

1.6 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.

1.7 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 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M Fire Protection Products.
2. Hilti, Inc.
3. Nelson Firestop Products.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping that is compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems 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.
c. Fire-rated form board.
d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. 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 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 84 13

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Construction joints in cast-in-place concrete.
b. Control and expansion joints in unit masonry.
c. Joints between different materials listed above.
d. Perimeter joints between materials listed above and frames of doors, and louvers.
e. Control joints in overhead surfaces.
f. Other joints as indicated.

2. Exterior joints in the following horizontal traffic surfaces:

a. Joints between different materials listed above.
b. Other joints as indicated.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry": Masonry control and expansion joint fillers and gaskets.
2. 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.

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.

1.3 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. Samples for Verification: For each type and color of joint sealant required. Install joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.
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.
F. 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.
G. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

H. Warranties: Special warranties specified in this Section.

1.4 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 along side 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.

1.5 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.

1.6 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.

1.7 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.
2. Urethane Sealants: 10 year material warranty.
3. Silicone Sealants: 20 year material warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of this Section.

2.2 MATERIALS, 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 sealant manufacturer based on testing and field experience.
B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range, unless otherwise indicated.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of this Section, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
B. Additional Movement Capability: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.
C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.4 LATEX JOINT SEALANTS

A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of this Section.

2.5 PREFORMED JOINT SEALANTS

A. Colored Preformed Foam Sealant: Provide manufacturer's standard preformed, precompressed, binary seal combining factory-applied cured silicone facing with expanding foam sealant backing; factory produced in precompressed sizes and in roll form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following:

1. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.
2. Impregnating Agent: Chemically stabilized acrylic.
3. Density: 8.4 to 9.1 lb/cu. ft.
4. Backing: Pressure-sensitive adhesive, factory applied to one side with protective wrapping.
5. Movement Capability: Plus 25 percent and minus 25 percent, 50 percent total movement.

6. Colors: As selected by Architect from manufacturer's full range, including Standard and Special colors, to match colors of materials adjacent to joints.

2.6 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.7 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 with 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. 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.
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. 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.

C. 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. Single-Component, Neutral-Curing Silicone Sealant:

1. Products: Provide one of the following:

a. GE Silicones; SilPruf SCS2000 or LM SCS2700.
b. Pecora Corporation; 864.
c. Polymeric Systems Inc.; PSI-641.
d. Tremco; Spectrem 3.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
6. Applications: Exterior non-traffic building joints in metal trim and drainage systems.

B. Mildew-Resistant Silicone Sealant:

1. Products: Provide one of the following:

a. Dow Corning; 786 Mildew Resistant.
b. GE Silicones; Sanitary SCS1700.
c. NUCO Industries, Inc.; NuFlex 302.
d. Pecora Corporation; 898.
e. Tremco; Tremsil 600 White.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50
4. Formulation: Formulated with fungicide.
5. Use Related to Exposure: NT (nontraffic).
6. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
7. Applications: Perimeter joints of plumbing fixtures, counters and backsplashes; and perimeter joints in ceramic tile.

C. Multicomponent Nonsag Urethane Sealant:

1. Products: Provide one of the following:

a. BASF; MasterSeal NP 2.
b. Pecora Corporation; Dynatrol II.
c. Tremco; Dymeric 240/240FC.
d. Tremco; Vulkem 922.
e. Sika Corporation, Inc.; Sikaflex - 2c NS TG.

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: Not less than 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
6. Applications: Exterior joints in non-traffic surfaces not indicated for another type of joint sealant.

END OF SECTION 07 9200

SECTION 07 95 00 - EXPANSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Types of joints for which architectural joint systems are specified include the following:

1. Interior pedestrian traffic joints.
2. Interior wall joints.
3. Interior ceiling joints.
4. Interior soffit joints.
5. Exterior wall joints.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete": Block-outs and cast-in anchorage and frames for architectural joint systems in concrete floors.
2. Division 07 "Roofing" Sections: Roof expansion joint systems.
3. Division 07 Section "Metal Flashing and Trim": Custom fabricated sheet metal expansion joint systems.
4. Division 07 Section "Joint Sealants": Elastomeric sealants and preformed compressed-foam sealants without metal frames.
5. Division 09 Sections: Walls, partitions, and floor finishes with expansion joints.

1.2 SUBMITTALS

A. Product Data: Include manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.
B. Shop Drawings: Provide placement drawings for each joint system specified.

1. Include line diagrams showing entire route of each joint system, plans, elevations, sections, details, joints, splices, locations of joints and splices, and attachments to other Work.
2. Where joint systems change planes, provide Isometric Drawings depicting how components interconnect to achieve continuity of joint covers and fillers.

C. Samples for Verification: Full-size units 6 inches long of each type of joint system indicated; in sets for each finish, color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain architectural joint systems through one source from a single manufacturer. Coordinate compatibility with adjoining joint systems specified in other Sections.
B. Fire-Test-Response Characteristics: Where indicated, provide joint systems incorporating fire barriers that are identical to those of assemblies tested for fire resistance per

ASTM E 119 and either ASTM E 814 or UL 2079, including hose-stream test of vertical wall assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated.

2.2 MATERIALS

A. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions; ASTM B 209, alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Preformed Seals: Single or multicellular extruded elastomeric seals designed with or without continuous, longitudinal, internal baffles. Formed to be installed in frames or with anchored flanges, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint.

1. Fire Barrier Products: Joint system manufacturer's standard or optional products that will maintain the fire rating of the fire-resistive construction in which the joint system is located.

D. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 ARCHITECTURAL JOINT SYSTEMS

A. General: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.

1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.
2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.

B. Floor-to-Floor and Floor to CMU/GWB Wall Joints: Metal frames and preformed seals for interior pedestrian traffic joints.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Model GFT-200 X 2" and GFTW-200 X2”; Conspec Systems Inc., C/S Group.
2. Nominal Joint Width: 2 inches.
3. Movement Capability: 25 percent.
4. Type of Movement Capability: Expansion and contraction.
5. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.
6. Preformed Seal Material: Manufacturer's standard thermoplastic gasket.
   a. Seal Color: Selected by Architect.
7. Exposed Frame Material: Aluminum.
8. Moisture Barrier: Provide manufacturer's standard unit.
9. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.

C. Gypsum Board Wall-to-Wall In-plane and Corner Joints: Metal frames and preformed seals for interior in-plane gypsum board joints.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Model FWF-200 and Thinline Corner Wall Cover, Model FWFC-200; Conspec Systems Inc., C/S Group.
2. Nominal Joint Width: 2 inches.
3. Movement Capability: 25 percent.
4. Type of Movement Capability: Expansion and contraction.
5. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.
6. Exposed Frame Material: Aluminum.
7. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.

D. Masonry Wall-to-Wall In-plane and Corner Joints: Metal frames and preformed seals for interior masonry wall joints.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Thinline Wall Cover, Model FWF-200 and Thinline Corner Wall Cover, Model FWFC-200 (with frame modified to suit condition); Conspec Systems Inc., C/S Group.
   b. FSWNE-200 (with frame modified to suit condition); MM Systems Corp.
2. Nominal Joint Width: 2 inches.
3. Movement Capability: 25 percent.
4. Type of Movement Capability: Expansion and contraction.

5. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.
6. Exposed Frame Material: Aluminum.
7. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.

E. Gypsum Board Ceiling Joints: Metal frames and preformed seals for interior in-plane gypsum board joints.

1. Basis-of-Design Product: Ribbed Seal Ceiling Cover, Model FCS-200; Conspec Systems Inc., C/S Group. Subject to compliance with requirements, provide the named product or comparable product by the following:

   a. FSW-200, MM Systems Corp.

2. Nominal Joint Width: 2 inches.
3. Movement Capability: 25 percent.
4. Type of Movement Capability: Expansion and contraction.
5. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.
6. Exposed Frame Material: Aluminum.
7. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.

F. Gypsum Board Ceiling Corner Joints: Metal frames and preformed seals for interior gypsum board ceiling corner joints.

1. Basis-of-Design Product: Ribbed Seal Ceiling to Wall Cover, Model FCSC-200; Conspec Systems Inc., C/S Group. Subject to compliance with requirements, provide the named product or comparable product by the following:

   a. FSWL-200, MM Systems Corp.

2. Nominal Joint Width: 2 inches.
3. Movement Capability: 25 percent.
4. Type of Movement Capability: Expansion and contraction.
5. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.
6. Exposed Frame Material: Aluminum.
7. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.

G. Suspended Acoustical Panel In-plane Ceiling Joints and Wall/Ceiling Joints: Preformed flexible seals for interior joints in acoustical panel ceilings, designed for use with ceiling suspension system grid members.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. HC-200 and HCW; Conspec Systems Inc., C/S Group.
    b. DX-200; MM Systems Corp.
2. Nominal Joint Width: 2 inches.
3. Movement Capability: 25 percent.
4. Type of Movement Capability: Expansion and contraction.
5. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.
6. Preformed Seal Material: Manufacturer's standard PVC.
    a. Seal Color: Manufacturer's standard white.

H. Exterior Wall Joints: Elastomeric compression seals for exterior wall joints.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. WABO Compression Seals, WE Series, Model WE-300; Watson Bowman Acme.
    b. CSS-200; Conspec Systems Inc., C/S Group.
    c. MAF-200; MM Systems Corp.
2. Nominal Joint Width: 2 inches.
3. Type of Movement Capability: Expansion and contraction.
4. Cyclic-Movement-Test-Response Characteristics: No evidence of visual fatigue, inability to cycle between designated joint widths, or other types of failure as determined by testing products identical to those indicated per ASTM E 1399 including Appendix X3.
5. Elastomeric Membrane Seal Material: Santoprene.
    a. Seal Color: [As selected by Architect from manufacturer's full range.] [Custom colors to match materials adjacent to joints, as approved by Architect.]

2.4 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to architectural joint system manufacturer's written instructions.

B. Coordinate and furnish anchorages, Placement Drawings, and instructions for installing joint systems to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.
C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for handling and installing architectural joint assemblies and materials, unless more stringent requirements are indicated.
B. Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.
C. Terminate exposed ends of exterior architectural joint assemblies with factory-fabricated termination devices to maintain waterproof system.
D. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.

1. Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
2. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
3. Set covers in horizontal surfaces at elevations that place exposed surfaces flush with adjoining finishes.
4. Locate wall, ceiling and soffit covers in continuous contact with adjacent surfaces.
5. Securely attach in place with required accessories.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

E. Continuity: Maintain continuity of joint systems with a minimum number of end joints and align metal members. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
F. Extruded Preformed Seals: Install seals to comply with manufacturer's written instructions and with minimum number of end joints.

1. For straight sections, provide preformed seals in continuous lengths.
2. For turns, follow manufacturer's instructions for preparing preformed seals for upturns and downturns, to maintain continuity and uniformity of seal section throughout turns.
3. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer.
4. Apply adhesive, epoxy, or lubricant adhesive approved by manufacturer to both frame interfaces before installing preformed seals.
5. Seal transitions according to manufacturer's written instructions.
6. Install foam seals with adhesive recommended by manufacturer and heat seal all splices.

G. Joint Systems with Seals: Seal end joints within continuous runs and joints at transitions according to manufacturer's written instructions to provide a watertight installation.
H. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and end joints.

3.3 CLEANING AND PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

END OF SECTION 07 9500

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Hollow metal doors.
2. Hollow metal door frames.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry": Installing anchors and grouting frames in masonry construction.
2. Division 08 Section "Door Hardware": Door hardware and weather stripping.
3. Division 09 Section "Painting and Coating": Field painting factory-primed doors and frames.

1.2 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.

1.3 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B. Shop Drawings: Show the following:

1. Elevations of each door design.
2. Details of doors including vertical and horizontal edge details.
3. Frame details for each frame type including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.

C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.4 QUALITY ASSURANCE

A. Hollow Metal Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

1.5 PRODUCT HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage.
B. 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.
C. Store doors and frames at building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

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 doors of sizes, thicknesses, and designs indicated.
B. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
2. Level 3 and Physical Performance Level A (Extra Heavy Duty).
    a. Model 2 (Seamless) unless otherwise indicated.
    b. Model 3 (Stile and Rail) where indicated.

3. Door Face Thickness: 0.053 inch (16 gage).

2.4 HOLLOW METAL FRAMES

A. General: Provide steel frames for doors and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
B. Frames of 0.067-inch-thick (14 gage) steel sheet for:

1. Door openings wider than 48 inches.
2. Exterior doors.

C. Supports and Anchors: Fabricated from not less than 0.042-inch-thick, electrolytic zinc-coated or metallic-coated steel sheet.
D. 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 FABRICATION

A. General: Fabricate hollow metal door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
B. 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.
C. 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.

D. 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.
E. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
F. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
G. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
H. 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.

I. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

J. Frame Construction: Fabricate frames to shape shown.

1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints unless otherwise indicated.
2. Fabricate knock-down, drywall slip-on frames for in-place gypsum board partitions.
3. Provide welded frames with temporary spreader bars.

K. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

L. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

2.6 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

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.

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 11 13

SECTION 08 14 16 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces with transparent finish.
2. Factory finishing flush wood doors with transparent finish.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. This Section includes requirements that wood products are obtained from forests certified by an FSC-accredited certification body.

C. Related Sections:

1. Division 08 Section "Hollow Metal Doors and Frames": Hollow metal frames for wood doors.
2. Division 08 Section "Door Hardware": Hardware for wood doors.
3. Division 08 Section "Glazing": Glass view panels in flush wood doors.

1.2 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include 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 requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.
6. Indicate configurations and layouts of factory-applied moldings

C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:

1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.

D. Samples for Verification:

1. Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
2. Frames for light openings, 6 inches long, for each material, type, and finish required.

E. Certificates of Chain-of-Custody: Signed by door manufacturers certifying that wood products were obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria." Include evidence that door manufacturer is certified for chain-of-custody by an FSC-accredited certification body.
F. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
C. Forest Certification: Provide doors made from wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."
D. Fire-Rated Wood Doors: Doors 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 NFPA 252 or UL 10C.

1. Test Pressure: Test at positive pressure.
    a. Except for 20 minutes doors, after 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
    b. For 20 minutes corridor doors, comply with NFPA 252 or UL 10C without the hose stream test.

2. Smoke Doors: Where smoke doors are indicated, comply with the following in addition to requirements for fire-rated doors:
    a. UL 1784, with test conducted according to International Building Code, Section 715.3.3.

3. Testing Agency Certification Labels: Provide labels for fire doors, and "S" labels for smoke doors.
4. Temperature-Rise Rating: At exit enclosures in buildings without approved fire suppression systems, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.

E. Fire Door Inspection: Provide one additional door leaf of typical size and with typical hardware preparation for fire-rated wood doors used for the project, for destructive testing to verify that internal blocking complies with requirements.

1. One fire-rated door will be selected at random by Architect. Remove face veneer as directed by Architect for inspection of internal construction.
2. If Architect determines that door construction does not comply with requirements, continue testing doors as designated by Architect until compliance can be verified.

1.4 PRODUCT HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.
B. Package doors individually in plastic bags or cardboard cartons.
C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

1. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. 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. Doors for Transparent Finish:

1. Grade: AWI Premium, with Grade AA faces.
2. Species and Cut: Select white birch, plain sliced.
3. Match between Veneer Leaves: Book / Slip match.
4. Assembly of Veneer Leaves on Door Faces: Balance match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Stiles: Applied wood-veneer edges of same species as faces and covering edges of faces.

2.3 SOLID-CORE DOORS

A. Structural Composite Lumber Cores: Comply with the following requirements:

1. Structural Composite Lumber: WDMA I.S. 10

a. Screw withdrawal Face: 700 lbf.
b. Screw withdrawal Edge: 400 lbf.

B. Interior Veneer-Faced Doors:

1. Core: Structural Composite Lumber.
2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering. Veneer shall be hot-pressed to core assembly.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability of not less than 1,000 lbs. and split resistance not less than 690 lbs. and with outer stile matching face veneer.

a. Provide rails of solid lumber or other material to comply with manufacturer's fire door approvals.
b. Provide edges with Type A concealed intumescent seals in locations where positive-pressure fire testing is indicated or required.

4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

a. Provide stiles with concealed intumescent seals in locations where positive-pressure fire testing is indicated or required.

5. Applied Moldings: UL Listed, solid lumber moldings matching species and cut specified for door faces; installed on both sides of door faces in the factory before doors are finished.

a. Profile: Algoma Hardwoods No. A-3; 1-1/4 by 9/16 inch.

2.4 LIGHT FRAMES

A. Wood Beads for Rectangular Light Openings in Wood Doors:

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.
3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.

B. Metal Frames for Light Openings in Fire Doors: Manufacturer's standard frame formed of 0.0478-inch-thick, cold-rolled steel sheet; factory primed and approved for use in doors of fire rating indicated.

2.5 FABRICATION

A. Factory Fitted Doors: Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. 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 measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing.
B. Finish doors at factory.
C. Transparent Finish:

1. Grade: Premium.

2. Finish: Manufacturer's standard finish with performance comparable to AWI System TR-4 conversion varnish.
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. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
D. 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 14 16

SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of overhead coiling doors:

1. Interior, manually-operated counter doors with galvanized steel / stainless steel / aluminum curtain.

B. Stainless steel counters and jamb liners for counter doors are included in this Section.
C. Related Sections include the following:

1. Division 05 Section "Formed Metal Fabrications": Stainless steel counters.
2. Division 05 Section "Formed Metal Counters": Counters located at counter doors.
3. Division 08 Section "Overhead Coiling Grilles."
4. Division 08 Section "Door Hardware": Lock cylinders and keying.
5. Division 26 Sections: Electrical service, disconnect switches, circuit breakers and connections for powered operators.

1.2 DEFINITIONS

A. Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.3 PERFORMANCE REQUIREMENTS

A. Operation-Cycle Requirements: Design overhead coiling door components and operator to operate for not less than 20,000 cycles.

1. Design auto-set fire door for 50,000 cycles.
2. Include tamperproof cycle counter concealed by hood.

1.4 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
2. Summary of forces and loads on walls and jambs.
3. Fire-Rated Doors: Information describing fire-release system, including testing and resetting instructions.

4. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied finishes.
D. Samples for Verification: Of each type of exposed finish required.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling door manufacturer for both installation and maintenance of units required for this Project.
B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.

1. Provide all types of overhead coiling doors and grilles for the Project produced by the same manufacturer.

C. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

D. SMACNA Standard: Fabricate fabrications to comply with the Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "Kitchen Equipment Fabrication Guidelines," unless otherwise indicated.
E. NSF Standards: Comply with applicable NSF International (NSF) standards and criteria for fabrications located in food services areas.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Subject to compliance with requirements, provide the following for applications indicated:

1. Interior Counter Door: Cornell Iron Works Inc.; Model No. ESC-10

B. Comparable Manufacturers: Subject to compliance with requirements, provide the named products or comparable products by one of the following:

1. Atlas Door Corp.; Div. of Clopay Building Products Co.
2. Cornell Iron Works Inc.
3. Overhead Door Corporation.
4. Raynor Garage Doors

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of material thickness recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Structural-quality, cold-rolled galvanized steel sheets complying with ASTM A 653, with G90 zinc coating.
2. Provide manufacturer's standard flat-profile slats; with outer face formed from metal not less than 0.0329 inch thick (20 gage), and inside face formed from metal not less than 0.0269 inch thick (22 gage).

B. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, either stainless-steel or aluminum extrusions to suit type of curtain slats.

1. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene, between angles or fitted to shape, as a cushion bumper for interior door.

D. Curtain Jamb Guides for Counter Doors: Fabricate curtain jamb guides of angles, or channels and angles of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel and removable stops on guides to prevent overtravel of curtain.

2.3 HOODS AND ACCESSORIES

A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weatherseal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

1. Fabricate steel hoods, for steel doors, of not less than 0.028-inch thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653.
   a. Finish: Match door curtain.

2. Include automatic drop baffle to guard against passage of smoke or flame for fire-rated assemblies.

B. Push/Pull Handles: Provide galvanized steel lifting handles on each side of door.
C. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.

1. Locking Bars: Full-disc Cremone type, both jamb sides, operable from inside and outside.
2. Provide manufacturer's standard lock cylinder, and deliver two keys to Owner.

D. Provide automatic-closing device inoperative during normal door operations, with governor unit complying with requirements of NFPA 80, with easily tested and reset release mechanism, and designed to be activated by the following:

1. Governor: Oscillating type or viscous-speed type, as standard with manufacturer.
2. Building fire alarm and detection system and door-holder-release devices.

2.4 COUNTERS AND JAMB LINERS

A. Stainless-Steel Sheet and Plate: ASTM A 666, Type 304, stretcher leveled.
B. Sealant for Counters in Food Preparation Areas: ASTM C 920; Type S, Grade NS, Class 25, Use NT; NSF certified and meeting requirements of FDA 21 CFR, Section 177.2600 for use in areas that come in contact with food.

1. Color: As selected by Architect from manufacturer's full range of colors.
2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

C. Fabricate stainless steel counters according to NSF 2 requirements. Factory assemble as single units to greatest extent possible.

1. For metal butt joints, comply with referenced SMACNA standard, unless otherwise indicated.
2. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
3. Provide surfaces in food zone, as defined in NSF 2, free from exposed fasteners.
4. Edges and Backsplashes: Provide counter edges and backsplashes indicated complying with referenced SMACNA standard.
5. Counters: Fabricate with reinforced tops to comply with referenced SMACNA standard, using stainless steel minimum 0.0781-inch-thick.

2.5 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment

accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

2.6 STEEL AND GALVANIZED STEEL FINISHES

A. Powder-Coat-Applied Finish: Apply manufacturer's standard powder-coat-applied finish consisting of primer and topcoat(s) according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.

1. Color and Gloss: As selected by Architect from manufacturer's full range.
2. Applications: Apply powder-coat finish to exterior coiling door assemblies.

2.7 MANUAL DOOR OPERATORS

A. Push-up Operation for Counter Doors: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25 lbf.

2.8 DOOR ASSEMBLY

A. Counter Door: Overhead coiling door formed with curtain of interlocking metal slats.
B. Door Curtain Material: Galvanized steel.
C. Door Curtain Slats: Flat profile slats of 1-1/4-inch (32-mm) center-to-center height.
D. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
E. Hood: Match curtain material and finish.

1. Shape: Square.
2. Mounting: Face of wall.

a. Integral Frame, Hood, and Fascia for Counter Door: Galvanized steel.

F. Sill Configuration for Counter Door: Integral metal sill at cafeteria (no sill at ticket booth or snack bar.
G. Locking Devices: Equip door with locking device assembly.

1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside and outside with cylinders.
2. Provide manufacturer's standard lock cylinder, and deliver two keys to Owner.

H. Manual Door Operator: Push-up operation.
I. Door Finish: Powder-Coated Finish: Color as indicated by manufacturer's

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.
B. Counters: Install counters and jamb liners level and plumb, according to fabricator's instructions and referenced standards.

1. Complete equipment field assembly, where required, using methods indicated.

a. Provide closed butt and contact joints that do not require a filler.
b. Grind field welds on stainless-steel counters smooth, and polish to match adjacent finish.

2. Securely anchor and attach counters and jamb liners to walls or bases with stainless-steel fasteners, unless otherwise indicated.
3. Install sealant in joints between fabrications and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

3.2 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.
B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
C. Test door closing when activated by detector or alarm connected fire-release system. Reset door-closing mechanism after successful test.

3.3 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Test door closing when activated by detector or alarm connected fire-release system. Reset door-closing mechanism after successful test.

2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
3. Review data in the maintenance manuals.
4. Schedule training with Owner with at least 7 days advance notice.

END OF SECTION 08 33 23

SECTION 08 33 26 - OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes motor-operated overhead coiling grilles.
B. Related Sections include the following:

1. Division 8 Section "Overhead Coiling Doors."
2. Division 8 Section "Overhead Coiling Grilles - Egress."
3. Division 8 Section "Door Hardware": Lock cylinders and keying.

1.2 DEFINITIONS

A. Operation Cycle: One complete cycle of a grille begins with the grille in the closed position. The grille is then moved to the open position and back to the closed position.

1.3 PERFORMANCE REQUIREMENTS

A. Operation-Cycle Requirements: Design overhead coiling grille components and operator to operate maximum of 25 cycles per day and for not less than 50,000 cycles for the life of the grille.

1.4 SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
2. Summary of forces and loads on walls and jambs.
3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by grille manufacturer and those provided by others.

C. Samples for Verification: Of each type of exposed finish required.
D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling grille manufacturer for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling grilles through one source from a single manufacturer.

1. Obtain operators and controls from the overhead coiling grille manufacturer.
2. Provide all types of overhead coiling doors and grilles for the Project produced by the same manufacturer.

C. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Cornell Iron Works, Inc.; Model 5015Subject to compliance with requirements, provide the named product or comparable product by one of the following:

1. Atlas Door Corp.; Div. of Clopay Building Products Co.
2. Overhead Door Corporation.
3. Raynor Garage Doors

2.2 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. General: Fabricate overhead coiling grille curtain consisting of a network of 5/16-inch-minimum diameter horizontal rods, or rods covered with tube spacers, spaced as indicated. Interconnect rods by vertical links approximately 5/8 inch wide, spaced as indicated and rotating on rods.

1. Link Spacing: Approximately 9 inches apart.
2. Aluminum Grilles: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated. Equip grilles with felt stripping to separate guide and curtain.

B. Bottom Bar: Manufacturer's standard continuous channel, tubular shape, or 2 angles, finished to match grille.

1. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene, between angles or fitted to shape, as a cushion bumper for interior grille.
2. Provide motor-operated grilles with combination bottom astragal and sensor edge.

C. Curtain Jamb Guides: Manufacturer's standard extruded-aluminum shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel. Provide removable stops on guides to prevent overtravel of curtain.

2.3 HOODS AND ACCESSORIES

A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

1. Provide removable metal soffit when hood is mounted above ceiling of same material and finish of curtain, unless otherwise indicated.

B. Where grille unit is power operated, provide safety interlock switch to disengage power supply when grille is locked.
C. Mounting Tube Frame: Provide manufacturer's standard mounting tube frame designed to support grille; factory fabricated from structural-steel tubes; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance grille by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to the curtain. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of curtain and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
D. Fabricate torsion rod for counterbalance shaft of case-hardened steel, sized to hold fixed spring ends and carry torsional load.
E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate.

2.5 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
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 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.
C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install grilles and operating equipment complete with necessary hardware, according to Shop Drawings, manufacturer's written instructions, and as specified.

3.2 ADJUSTING

A. Lubricate bearings and sliding parts; adjust grilles to operate easily, free from warp, twist, or distortion and fitting tight for entire perimeter.

3.3 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Schedule training with Owner with at least 7 days advance notice.

END OF SECTION 08 33 26

SECTION 08 33 26.13 - OVERHEAD COILING GRILLES - EGRESS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Electrically operated access-controlled egress rolling grilles that provide alarm and fail-safe automatic opening emergency response and automatic locking capabilities.
B. Related Sections:

1. Division 05 Section “Metal Fabrications” for miscellaneous steel supports.
2. Division 08 Section “Door Hardware Sets”: Lock cylinders and keying.
3. Division 08 Section “Overhead Coiling Doors”.
4. Division 08 Section “Overhead Coiling Grilles”.
5. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, and installation of control station and wiring.

C. Products Furnished, But Not Installed Under This Section:

1. Control station.
2. IBC and ICC/ANSI A117 compliant Emergency Exit Push-Button Station and Signage.
3. Local Horn/Strobe Alarm for Emergency Exit Push-Button Station.

1.2 DEFINITIONS

A. Operation Cycle: One complete cycle of a grille begins with the grille in the closed position. The grille is then moved to the open position and back to the closed position.

1.3 PERFORMANCE REQUIREMENTS

A. Operation Cycle Requirements: Design overhead coiling grille components and operator to operate for not less than 20,000 cycles.

1.4 SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.

2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices, and other accessories.
5. Wiring Diagrams: Detail wiring for power, signal and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by grille manufacturer and those provided by others.

C. Samples for Verification: For each type of exposed finish required.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
B. Source Limitations: Obtain overhead grilles through one source from a single manufacturer.

1. Obtain operators and controls from the overhead coiling grille manufacturer.
2. Provide all types of overhead coiling doors and grilles for the Project produced by the same manufacturer.

C. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

1. The Terms “Listed” and “Labeled”: As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” as defined in OSHA Regulation 1910.7.

1.6 DELIVERY STORAGE AND HANDLING

A. Follow manufacturer's written instructions.

1.7 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Product: Cornell Iron Works, Inc.; Model ERG-IBC.
B. Comparable Products: Subject to compliance with requirements, provide the basis-of-design product indicated or comparable product by one of the following:

1. Atlas Door Corp.; Div. of Clopay Building Products Co.
2. Overhead Door Corporation.
3. Wayne-Dalton Corp.
4. Raynor Garage Doors

C. GRILLE SCHEDULE

1. EG-01, EG-02, EG-03, EG-04

2.2 MATERIALS AND CONSTRUCTION

A. General: Fabricate overhead coiling grille curtain consisting of a network of 5/16-inch minimum diameter horizontal rods, or rods covered with tube spacers, spaced as indicated. Interconnect rods by vertical links approximately 5/8-inch wide, spaced as indicated and rotating on rods.

1. Horizontal Rods: Rod Spacing: Approximately 2 inches o.c.
2. Vertical Chains: Link Spacing: Approximately 9 inches apart.
3. Bottom Bar: Aluminum Grilles: ASTM B221, allow and temper recommended by aluminum producer and finisher for type of use and finish indicated. Equip grilles with felt stripping to separate guide and curtain.
4. Finish:
   a. Aluminum Curtain and Bottom Bar:
5. Curtain: Clear anodized.

B. Guides, Tube Mounted: Manufacturer’s standard heavy-duty extruded aluminum shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel. Provide removable stops on guides to prevent overtravel of curtain.

1. Provide recessed steel tube and mounting angles as required for mounting configuration indicated on Drawings.
   a. Finish: Powder coat to match guide finish.

C. End Locks: Continuous end links, chains or other devices at ends of rods, locking and retaining grille curtain in guides against excessive pressures, maintaining curtain alignment, and preventing lateral movement.
D. Bottom Bar: Manufacturer’s standard continuous channel, tubular shape, or two angles, finished to match grille.

1. Astragal: Provide a replaceable, adjustable, continuous compressible gasket of flexible vinyl, rubber or neoprene, between angles or fitted to shape, as a cushion bumper for interior grille.
2. Provide motor-operated grilles with combination bottom astragal and sensor edge.

2.3 HOODS AND ACCESSORIES

A. Provide removable metal soffit when hood is mounted above ceiling of same material and finish of curtain, unless otherwise indicated.
B. Concealed Self Locking Mechanism: Provide manual lifting jamb lock assemblies that will prevent forced opening of a closed grille. Lock mechanism shall not interfere with normal electric operation, fail-safe or emergency response self opening features.

1. Basis-of-Design Product: Cornell Iron Works, Inc., AutoLock.
2. Lock cylinder is specified in Division 8 Section "Door Hardware Sets."
3. Where grille unit is power operated, provide safety interlock switch to disengage power supply when grille is locked.

C. Mounting Tube Frame: Provide manufacturer's standard mounting tube frame designed to support grille; factory fabricated from structural-steel tubes; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance grille by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to the curtain. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of curtain and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
D. Fabricate torsion rod for counterbalance shaft of case-hardened steel, sized to hold fixed spring ends and carry torsional load.
E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate.

1. Finish: Manufacturer’s standard polyester powder coat.
    a. Colors: As selected by Architect from manufacturer’s full range.

2.5 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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 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.
C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

2.6 ELECTRIC GRILLE OPERATORS

A. General: Provide electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operational life specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.
B. Emergency Egress: Provide emergency egress operator system compliant with applicable codes, with self-locking mechanism that automatically unlocks, automatically releases, and opens grille fully to permit passage upon activation by central smoke/fire alarm system, emergency exit push-button station or if power is not available.
C. Comply with NFPA 70.
D. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
E. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
F. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.
G. Grille-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft grille operator unit consisting of electric motor, enclosed worm-gear running-in-oil primary drive, chain and sprocket secondary drive, and quick disconnect-release for manual operation.
H. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate grille in either direction, from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or considering service factor.

    1. Type: Polyphase, medium-induction type.
    2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
    3. Coordinate wiring requirements and electric characteristics of motors with building electrical system.
    4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
    5. Provide totally enclosed, nonventilated or fan-cooled motors, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure where indicated.

6. Provide enclosure cover for motors mounted exposed below the ceiling.

I. Remote-Control Station: Provide momentary-contact, keyed, three-position control station with labeled "Open," "Close," and "Stop" positions.

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
2. Lock cylinder is specified in Division 8 Section "Door Hardware."

J. Obstruction Detection Device: Provide each motorized grille with indicated external automatic safety sensor able to protect full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel. UL 325-2010 compliant Entrapment for Motor Operation.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in grille opening without contact between grille and obstruction.
2. Sensor Edge: Provide each motorized grille with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward grille travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Provide pneumatically actuated automatic bottom bar.

K. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
C. Commencement of work by installer is acceptance of substrate.

3.2 INSTALLATION

A. General: Install grille and operating equipment with necessary hardware, anchors, inserts, hangers and supports.
B. Follow manufacturer's installation instructions.

3.3 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust grilles for ease of operation, free from warp, twist, or distortion.

3.4 FIELD QUALITY CONTROL

A. Site Test: Test grilles for normal operation and the emergency opening feature by means of alarm, power failure and emergency exit push-button station at door opening. Coordinate with Authority Having Jurisdiction to witness test.

3.5 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.
B. Remove surplus materials and debris from the site.

3.6 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
3. Review data in the maintenance manuals.
4. Schedule training with Owner with at least 7 days advance notice.

END OF SECTION 08 33 26.13

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior aluminum stile and rail glazed entrance doors.
2. Vestibule doors and other interior doors matching entrance doors.
3. Frames for entrances.
4. Storefront-type framing system for exterior glazed openings, including the following:
    a. Fixed glass.
5. Storefront-type framing system for interior applications.

B. Related sections include the following:

1. Division 07 Section "Joint Sealants": Joint sealants installed as part of storefront systems.
2. Division 08 Section "Flush Wood Doors": Interior wood doors in storefront framing.
3. Division 08 Section "Door Hardware": Lock cylinders for entrances and other hardware not specified in this Section.
4. Division 08 Section "Glazing": Glass and glazing for storefront systems.

1.2 SYSTEM DESCRIPTION

A. General: Provide aluminum-framed storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:

1. Air infiltration and water penetration exceeding specified limits.
2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Glazing: Physically and thermally isolate glazing from framing members.

C. Thermally Broken Construction: Provide systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.

D. Wind Loads: Provide aluminum-framed storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent. Determine wind loads by calculations based on load criteria indicated on Drawings.

1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller, unless otherwise indicated.
2. Static-Pressure Test Performance: Provide aluminum-framed storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.
    a. Test Pressure: 150 percent of inward and outward wind-load design pressures.
    b. Duration: As required by design wind velocity; fastest 1 mile of wind for relevant exposure category.

E. Dead Loads: Provide aluminum-framed storefront system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.

1. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.
2. Provide a minimum 1/16-inch clearance between members and operable windows and doors.

F. Live Loads: Provide aluminum-framed storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

G. Air Infiltration: Provide aluminum-framed storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft.

H. Water Penetration: Provide aluminum-framed storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. Water leakage is defined as follows:

1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

I. Thermal Movements: Provide aluminum-framed storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

J. Structural-Support Movement: Provide aluminum-framed storefront systems that accommodate structural movements including, but not limited to, sway and deflection.
K. Condensation Resistance: Provide storefront systems with condensation resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.1.
L. Average Thermal Conductance: Provide storefront systems with average U-values of not more than 0.63 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.1.
M. Dimensional Tolerances: Provide aluminum-framed storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.3 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
B. Shop Drawings: For aluminum-framed storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.

1. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.

C. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
D. Cutaway Sample: Of each vertical-to-horizontal framing intersection of systems, made from minimum 6-inch lengths of full-size components and showing details of the following:

1. Joinery.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
F. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of aluminum-framed storefront systems with requirements based on comprehensive testing of current systems.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing aluminum-framed storefront systems similar to those required for this Project and who is acceptable to manufacturer.

1. Engineering Responsibility: Prepare data for aluminum-framed storefront systems, including Shop Drawings, based on testing and engineering analysis of

manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of aluminum-framed storefront system through one source from a single manufacturer.
C. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions 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, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.6 WARRANTY

A. General Warranty: The special warranty 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 Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of aluminum-framed storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Failure of system to meet performance requirements.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Failure of operating components to function normally.
5. Water leakage through fixed glazing and frame areas.
6. Warranty Period: 2 years from date of Substantial Completion.

C. 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 MANUFACTURERS

A. Basis-of-Design Manufacturer: Provide the products specified below, by Kawneer Company, Inc.

1. Storefront Framing Systems: Kawneer Trifab Versaglaze 601/601T/601UT
2. Stile and Rail Aluminum Doors: Kawneer 500 Swing Doors.

B. Comparable Manufacturers: Subject to compliance with requirements, provide the specified products or comparable products by the following:

1. Tubelite
2. YKK AP America

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Bars, Rods, and Wire: ASTM B 211.
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Complying with ASTM A 36 for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 for hot-rolled sheet and strip.
C. Glazing as specified in Division 08 Section "Glazing."
D. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
E. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.
F. Secondary Sealant: For use as weatherseal, compatible with structural silicone sealant and other system components with which it comes in contact, and that accommodates a 50 percent increase or decrease in joint width at the time of application when measured according to ASTM C 719.

1. Color: Black.
2. Use neutral-cure silicone sealant with insulating-glass units.

G. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
H. Sealants and joint fillers for joints at perimeter of aluminum-framed storefront systems as specified in Division 07 Section "Joint Sealants."

I. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

2.3 COMPONENTS

A. Framing Systems: Provide primary storefront framing member sizes as follows, with types corresponding to designations on Drawings:

1. Storefront Type: 1-3/4 by 4-1/2 inches.

B. Stile and Rail Doors: Provide manufacturer's standard 1-3/4-inch-thick glazed doors with minimum 0.125-inch-thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.

1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
2. Door Design: Wide stile; 5-inch nominal width.
3. Door Design: As indicated on Drawings.
4. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
5. Intermediate Rails: Provide vertical and horizontal intermediate rails in doors, of configurations indicated on Drawings.

C. Subframes and Sills: Provide subframes and sills with anchors for frame units as shown, of profile and dimensions indicated but not less than 0.062-inch-thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match frames.

D. Trim and Closures: Provide trim, cover plates and other closures, for both exterior and interior conditions as shown, matching storefront framing, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of frame units due to thermal expansion and building deflections.

1. Include cladding for structural members supporting sunscreen assemblies adjacent to storefront systems.

E. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.

F. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to retain fastener threads.
2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

G. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

H. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.

I. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:

1. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.

J. Brixwell CTC12 Brushed Stainless Steel 12” x 10” x 2” Standard Counter Top Deal Tray

1. Installed per manufacturer’s recommendations.

K. Quickserv Natural Voice Speak-thru for Ticket Window, CSE-QS-NV by Quickserv, or equal approved by architect

1. Installed per manufacturer's recommendations.

2.4 HARDWARE

A. Hardware: As specified in Division 08 Section "Door Hardware."

1. Coordinate with specified products.

2.5 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

1. Fabricate components for screw-spline frame construction.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. 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.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

1. Provide glazing stops to accommodate stained glass panels furnished by Owner in locations indicated.

G. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape

recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Framing System: Fabricate framing in profiles indicated for flush glazing (without projecting stops).

1. Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system, to withstand imposed loads, and to maintain indicated width and depth of primary frame members.
2. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

I. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

1. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. Interior Doors: Provide ANSI/BHMA A156.16 silencers at stops to prevent metal to metal contact. Provide 3 silencers on strike jamb of single-door frames and 2 silencers on head of double-door frames.

2.6 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
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 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.
C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
D. 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 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.
    a. Include custom color selection to match interior trim as noted on finish schedule.

2.7 STEEL PRIMING

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.
B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.
C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

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 aluminum-framed storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing aluminum-framed storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. 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 and condensation and moisture occurring or migrating within the system to the exterior.
D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 07 Section "Joint Sealants."
E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

    1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.

G. Install glazing to comply with requirements of Division 08 Section "Glazing," unless otherwise indicated.
H. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

I. Install perimeter sealant to comply with requirements of Division 07 Section "Joint Sealants," unless otherwise indicated.

1. Provide neat, uniform sealant joints with bead formed by edges of framing members. Remove excess sealant which overlaps onto adjacent face of framing members during application of sealants.

J. Erection Tolerances: Install aluminum-framed storefront systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform field quality-control testing indicated.
B. Hose Stream Test: After completing the installation of test areas indicated, test storefront system for water penetration according to AAMA 501.2 requirements.

1. Perform tests on two locations for each different storefront condition.
2. Continue testing until obtaining two consecutive passing results for each different storefront condition.

C. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

3.4 ADJUSTING AND PROTECTION

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.
B. Remove excess sealant and glazing compounds, and dirt from surfaces.
C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure aluminum-framed storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 41 13

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes conventionally glazed aluminum curtain walls installed as stick systems, and the following:

1. Metal spandrel panels.
2. Frame adapters for entrance doors set in curtain wall construction.

B. Related Sections include the following:

1. Division 07 Section "Fire-Resistive Joint Systems": Perimeter fire-containment systems (safing insulation) field installed with curtain wall systems.
2. Division 07 Section "Joint Sealants": Installation of joint sealants installed with glazed aluminum curtain-wall systems and for sealants to the extent not specified in this Section.
3. Division 08 Section "Aluminum-Framed Entrances and Storefronts": Entrance systems installed with glazed aluminum curtain-wall systems.
4. Division 08 Section "Door Hardware": Operating hardware for entrances.
5. Division 08 Section "Glazing": Glass requirements.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide glazed aluminum curtain-wall systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
3. Dimensional tolerances of building frame and other adjacent construction.
4. Failure includes the following:
    a. Deflection exceeding specified limits.
    b. Thermal stresses transferred to building structure.
    c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
    d. Noise or vibration created by wind and thermal and structural movements.
    e. Loosening or weakening of fasteners, attachments, and other components.
    f. Sealant failure.

B. Structural Loads:

1. Wind Loads: Provide glazed aluminum curtain wall system, including anchorage, capable of withstanding wind-load design pressures calculated according to

requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent. Determine wind loads by calculations based on load criteria indicated on Drawings.

2. Seismic Loads: Provide glazed aluminum curtain wall system, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 9, "Earthquake Loads," whichever are more stringent.

C. Structural-Test Performance: Provide glazed aluminum curtain-wall systems, including anchorage, capable of withstanding test pressure indicated without material and deflection failures and permanent deformation of structural members exceeding 0.2 percent of span when tested according to ASTM E 330.

1. Submit reports of tests performed on manufacturer's standard assemblies.
2. Test Pressure: 150 percent of positive and negative wind-load design pressures.
3. Test Duration: As required by design wind velocity but not less than 60 seconds.

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span or 3/4 inch, whichever is smaller.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

    a. Operable Doors: Provide a minimum 1/16-inch clearance between framing members and operable units.

E. Thermal Movements: Provide glazed aluminum curtain-wall 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.

F. Air Infiltration: Provide glazed aluminum curtain-wall systems with maximum air leakage of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.

G. Water Penetration Under Static Pressure: Provide aluminum glazed curtain-wall systems that do not evidence water penetration when tested according to ASTM E 331 at a minimum differential static pressure of 20 percent of positive design wind load, but not less than 10 lbf/sq. ft.

1. Maximum Water Leakage: No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

H. Condensation Resistance: Provide glazed aluminum curtain-wall systems with condensation-resistance factor (CRF) of not less than 55 when tested according to AAMA 1503.
I. Average Thermal Conductance: Provide glazed aluminum curtain-wall systems with average U-factor of not more than 0.66 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
B. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of glazed aluminum curtain-wall systems.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

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. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for glazed aluminum curtain-wall systems.
F. Field quality-control test reports.
G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing Work of this Section and who is acceptable to manufacturer.

1. Engineering Responsibility: Preparation of data for glazed aluminum curtain-wall systems, including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.
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 modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain-wall systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating glazed aluminum curtain-wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.6 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain-wall systems that do not comply with requirements or that deteriorate as defined in this Section 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. Water leakage.
   e. Failure of operating components to function normally.

2. Warranty Period: 2 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 fail 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 MANUFACTURERS

A. Basis-of-Design Products: The design for glazed aluminum curtain-wall systems is based on the following products of Kawneer Company, Inc.:

1. Curtain Wall System: 1600 Wall System 1.

B. Comparable Products: Subject to compliance with requirements, provide the named products or comparable products as follows:

1. EFCO Corporation;
2. Wausau Windows and Wall Systems:
3. Tubelite;

2.2 FRAMING SYSTEMS

A. Framing System Sizes: Provide primary curtain wall framing member sizes as follows, with types corresponding to designations on Drawings:

1. Curtain Wall: 2-1/2 by 7-1/2 inches.

B. 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, Shapes, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

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. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. 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.
3. Use exposed fasteners with countersunk Phillips screw heads.
4. Finish exposed portions to match framing system.
5. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.

F. Anchors: Three-way adjustable anchors 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.

G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
H. Framing Gaskets: As recommended by manufacturer for joint type.
I. Framing Sealants: As recommended by manufacturer for joint type, and as specified in Division 07 Section "Joint Sealants."

2.3 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."
B. Glazing Sealants: As recommended by manufacturer for joint type, and as specified in Division 08 Section "Glazing."

2.4 AUXILIARY COMPONENTS

A. Fillers, Trim and Closures: Provide filler panels, trim, cover plates, mullion covers, column covers and other closures, for both exterior and interior conditions as shown, complete with anchors for support to structure. Allow for erection tolerances and provide for movement of curtain wall due to thermal expansion and building deflections, as indicated.

1. Include cladding for structural members supporting sunscreen assemblies adjacent to storefront systems.

B. Metal Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.

1. Overall Panel Thickness: 1/2 inch.
2. Exterior Skin: Aluminum.

a. Thickness: Manufacturer's standard for finish and texture indicated.
b. Finish: Matching framing system.
c. Texture: Smooth.
d. Backing Sheet: 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene.

3. Interior Skin: Aluminum.

a. Thickness: Manufacturer's standard for finish and texture indicated.
b. Finish: Matching aluminum framing.
c. Texture: Smooth.
d. Backing Sheet: 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene.

4. Core: ½ inch plywood.
5. Surface-Burning Characteristics: For exposed interior surfaces of panels, when tested according to ASTM E 84 as follows:

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

C. Entrance Frame Adapters: Manufacturer's standard system designed to integrate specified entrance doors into curtain wall system.

2.5 ACCESSORY MATERIALS

A. Perimeter Fire-Containment Systems (Safing Insulation): Specified in Division 07 Section "Fire-Resistive Joint Systems."
B. Insulating Materials: Specified in Division 07 Section "Thermal Insulation."
C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.6 FABRICATION

A. Fabricate framing in profiles indicated.

1. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
2. Form aluminum shapes before finishing.
3. Provide reinforcing required for a complete system, to withstand imposed loads, and to maintain indicated width and depth of primary frame members.

B. Fabricate components that, when assembled, have the following characteristics:

1. Sharp profiles, straight and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Internal guttering systems or other means to drain water passing joints, condensation occurring 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 prevent glazing-to-glazing contact and to maintain required glazing edge clearances.
6. Provisions for reglazing from exterior.

C. 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.
D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISH

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
C. 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 2605 and 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, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. 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. 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 will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or 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. Install components plumb and true in alignment with established lines and grades.
E. Install operable doors level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
F. Install glazing as specified Division 08 Section "Glazing."
G. Install sealants as specified in Division 07 Section "Joint Sealants."
H. Install perimeter fire-containment systems (safing insulation) as specified in Division 07 Section "Fire-Resistive Joint Systems."
I. Erection Tolerances: Install glazed aluminum curtain-wall systems 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 greater, 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.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
B. Testing Services: Conduct testing and inspecting of representative areas to determine compliance of installed system. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Water Spray Test: After the installation of minimum area of 75-feet-by-2-story glazed aluminum curtain-wall system has been completed but before installation of interior finishes has begun, a 2-bay area of system designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING AND PROTECTION

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.
B. Remove excess sealant and glazing compounds, and dirt from surfaces.
C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure aluminum-framed curtain wall system is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 44 13

SECTION 08 71 00 – DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, and hollow metal doors.
B. Hardware for fire-rated doors.
C. Electrically operated and controlled hardware.
D. Lock cylinders for doors with balance of hardware specified in other sections.
E. Thresholds.
F. Smoke and draft control seals.
G. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.
B. Section 081116 - Aluminum Doors and Frames.
C. Section 081213 - Hollow Metal Frames.
D. Section 081416 - Flush Wood Doors.
E. Section 281000 - Access Control: Electronic access control devices.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
B. BHMA A156.1 - Standard for Butts and Hinges 2021.
C. BHMA A156.2 - Bored and Preassembled Locks and Latches 2017.
D. BHMA A156.3 - Exit Devices 2020.
E. BHMA A156.4 - Door Controls - Closers 2019.
F. BHMA A156.8 - Door Controls - Overhead Stops and Holders 2021.
G. BHMA A156.13 - Mortise Locks & Latches Series 1000 2017.
H. BHMA A156.16 - Auxiliary Hardware 2018.
I. BHMA A156.18 - Materials and Finishes 2020.
J. BHMA A156.21 - Thresholds 2019.
K. BHMA A156.25 - Electrified Locking Devices 2018.
L. BHMA A156.26 - Standard for Continuous Hinges 2021.
M. BHMA A156.28 - Recommended Practices For Mechanical Keying Systems 2018.
N. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames 2016.
O. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.
P. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.
Q. DHI (KSN) - Keying Systems and Nomenclature 2019.
R. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

T. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

U. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

V. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting four weeks prior to commencing work of this section; require attendance by affected installers and the following:
   1. Architect.
   2. Installer's Architectural Hardware Consultant (AHC).
   3. Hardware Installer.
   4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting: Arrange meeting with Owner, Architect and finish hardware supplier to determine keying requirements immediately upon receipt of finishing hardware schedule.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.
      - Submit in vertical format.
   3. List groups and suffixes in proper sequence.
   4. Include complete description for each door listed.
   5. Include manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   6. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Include diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).

2. Elevations: Include front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
3. Diagrams: Include point-to-point wiring diagrams that show each device in door opening system with related colored wire connections to each device.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Supplier's qualification statement.

I. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
1. Include manufacturer's parts lists and templates.
2. Bitting List: List of combinations as furnished.

J. Keying Schedule:
1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

K. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

L. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

M. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
   1. Closers: Ten years, minimum.
   2. Exit Devices: Five years, minimum.
   3. Locksets and Cylinders: Ten years, minimum.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Locks: Provide a lock for each door, unless it's indicated that lock is not required.
   1. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's Series. As indicated in hardware sets.
   2. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.
   3. Strikes:
      - Finish: To match lock or latch.
      - Curved-Lip Strikes: Provide as standard, with extended lip to protect frame, unless otherwise indicated.
      - Center Strike At Pairs of Doors:7/8 inch (22.2 mm) lip.

D. Closers:
   1. Provide door closer on each exterior door, unless otherwise indicated.
   2. Provide door closer on each fire-rated and smoke-rated door.
   3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

E. Overhead Stops and Holders (Door Checks).
   1. Provide stop for every swinging door, unless otherwise indicated.
   2. Overhead Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop, unless otherwise indicated.
   3. Overhead stop is not required if a floor or wall stop has been specified for the door.

F. Drip Guards: Provide at head of outswinging exterior doors unless protected by roof or canopy directly overhead.

G. Thresholds:
   1. Exterior Applications: Provide at each exterior door, unless otherwise indicated.

H. Smoke and Draft Control Seals:
   1. Provide gasketing for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.

I. Weatherstripping and Gasketing:
   1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   2. Provide door bottom sweep on each exterior door, unless otherwise indicated.

J. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

K. See Section 281000 for additional access control system requirements.

L. Fasteners:
1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
    - Aluminum fasteners are not permitted.
    - Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
    - Self-drilling (Tek) type screws are not permitted.
3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
4. Provide wall grip inserts for hollow wall construction.
5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
    - Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
    - Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:
1. Applicable provisions of federal, state, and local codes.
    - NFPA 101.
2. Accessibility: ADA Standards and ICC A117.1.
3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
5. Hardware for Smoke and Draft Control Doors: Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

2.03 HINGES

A. Manufacturers: Conventional butt hinges.
1. BEST; dormakaba Group:
2. Mckinney.
3. Ives Hardware.

B. Properties:
1. Butt Hinges: As applicable to each item specified.
    - Standard Weight Hinges: Minimum of two (2) permanently

lubricated non-detachable bearings.
- Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
- Template screw hole locations.
- Bearings: Concealed fully hardened bearings.
- UL 10C listed for fire-resistance-rated doors.

C. Sizes: See Door Hardware Schedule.
1. Hinge Widths: As required to clear surrounding trim.
2. Sufficient size to allow 180 degree swing of door.

D. Finishes: See Door Hardware Schedule.
1. Fully polish hinges; front, back, and barrel.

E. Grades:
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
2. Comply with BHMA A156.18 Materials and Finishes.

F. Material: Base metal as indicated for each item by BHMA material and finish designation.

G. Types:
1. Butt Hinges: Include full mortise hinges.

H. Options: As applicable to each item specified.

I. Quantities:
1. Butt Hinges: Three (3) hinges per leaves up to 90 inches (2286 mm) in height. Add one (1) for each additional 30 inches (762 mm) in height or fraction thereof.
- Hinge weight and size unless otherwise indicated in hardware sets:
  a) For doors up to 36 inches (914 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.134 inch (3.4 mm) and a minimum of 4-1/2 inches (114 mm) in height.
  b) For doors from 36 inches (914 mm) wide up to 42 inches (1067 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.145 inch (3.7 mm) and a minimum of 4-1/2 inches (114 mm) in height.
  c) For doors from 42 inches (1067 mm) wide up to 48 inches (1219 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
  d) For doors greater than 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.

J. Applications: At swinging doors.
1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

K. Products:
1. Butt Hinges:
- Ball Bearing, Five (5) Knuckle.

2.04 CONTINUOUS HINGES

A. Manufactures:

1. Best Access
2. Roton
3. Select Hardware

Geared Continuous Hinges: As applicable to each item specified.

1) Non-handed.
2) Anti-spinning through-fastener.
3) UL 10C listed for fire-resistance-rated doors.
   (a) Metal Door Installation: Rated up to 90 minutes.
   (b) Wood Door Installation: Rated up to 60 minutes.
4) Sufficient size to permit door to swing 180 degrees

B. Finishes: See Door Hardware Schedule.

2.05 BOLTS

A. Manufacturers:
   1. ABH.
   2. Burns.
   3. Trimco.
B. Properties:
   1. Dustproof Strikes: For bolting into floor, provide except at metal thresholds.
C. Options:
   1. Extension Bolts: In leading edge of door, one bolt into floor, one bolt into top of frame.
   2. Lever extensions: Provide for top bolt at oversized doors.

2.06 EXIT DEVICES

A. Manufacturers:
   1. Precision Apex 2000 Series
   2. Sargent 19GL80 Series.
   3. Von Duprin 98 Series
B. Properties:
   1. Actuation: Crossbar.
   2. Touchpads: 'T" style metal touchpads and rail assemblies with matching chassis covers end caps.
   3. Latch Bolts: Stainless steel deadlocking with 3/4 inch (19 mm) projection using latch bolt.
   4. Lever Design: Match project standard lockset trims.
   5. Cylinder: Include where cylinder dogging or locking trim is indicated.
   6. Strike as recommended by manufacturer for application indicated.
   7. Dogging:
      - Non-Fire-Resistance-Rated Devices: Cylinder 1/4 inch (6 mm) hex key dogging.
      - Fire-Resistance-Rated Devices: Manual dogging not permitted.
   8. Touch bar assembly on wide style exit devices to have a 1/4 inch (6.3 mm) clearance to allow for vision frames.
   9. All exposed exit device components to be of architectural metals and "true" architectural finishes.
   10. Handing: Field-reversible.
   11. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.
   12. Vertical Latch Assemblies' Operation: Gravity, without use of springs.
C. Grades: Complying with BHMA A156.3, Grade 1.

1. Provide exit devices tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.

D. Standards Compliance:
1. UL Listed for Panic and Fire for Class II Circuitry.
2. Provide UL (DIR) listed exit device assemblies for fire-resistance-rated doors.
3. Comply with UL 10C.

E. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.
1. Listed by UL as a Controlled Exit Device (FULA) and Special Locking Arrangements (FWAX) category.

F. Options:
1. Electrified Devices:
2. Delayed Egress Devices: Manufacturer's standard for the application.
3. Internally mounted switch used to signal other components.
4. Internally mounted switch that monitors the position of the latchbolt.
5. MLR: Motorized latch retraction.

G. Products:
1. 2000.

2.07 ELECTRIC STRIKES

A. Manufacturers:
1. RCI
2. HES.
3. Allegion.

B. Properties:
1. Provide UL 1034 compliant devices.
2. Provide UL 10C compliant devices.
3. Include transformer and rectifier as necessary for complete installation.

C. Installation: Connect electric strikes into fire alarm where non-rated doors are scheduled to release with fire or sprinkler alarm condition.

2.08 LOCK CYLINDERS

A. Manufacturers:
1. BEST CORMAX Plus, Existing District System
2. No Substitution.

B. Material:
1. Manufacturer's standard corrosion-resistant brass alloy.

C. Types: As applicable to each item specified.
1. Patented small format interchangeable core (SFIC) type cylinders, with seven pin cores.

2.09 MORTISE LOCKS

A. Manufacturers:
1. BEST, 45H Series, Existing District System.
2. No Substitution

B. Properties:
1. Mechanical Locks: Manufacturer's standard.
    - Fitting modified ANSI A115.1 door preparation.

- Door Thickness Coordination Fitting 1-3/4 inch (44 mm) to 2-1/4 inch (57 mm) thick doors.
- Latch: Solid, one-piece, anti-friction, self-lubricating stainless steel.

a) Latchbolt Throw: 3/4 inch (19 mm), minimum.

- Auxiliary Deadlatch: One piece stainless steel, permanently lubricated.
- Backset: 2-3/4 inch (70 mm).
- Lever Trim:

a) Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latchbolt assembly.
b) Strength: Locksets outside locked lever designed to withstand minimum 1,400 inch-lbs (158.2 Nm) of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
c) Spindle: Designed to prevent forced entry from attacking of lever.
d) Independent spring mechanism for each lever.

- Trim to be self-aligning and thru-bolted.

2. Electrified Locks: Same properties as standard locks, and as follows:
   - Function: Electrically locked (Fail Safe) or unlocked (Fail Secure), as indicated for each lock in Door Hardware Schedule.

C. Finishes: See Door Hardware Schedule.
   1. Core Faces: Match finish of lockset.

D. Grades:

E. Products: Mortise locks, including standard and electrified types.
   1. 45H.

2.10 CYLINDRICAL LOCKS

A. Manufacturers:
   1. BEST 9K Series, Existing District System.
   2. No Substition.

B. Properties:
   1. Mechanical Locks:
      a. Fitting modified ANSI A115.2 door preparation.
      b. Door Thickness Fit: 1-3/8 inches (35 mm) to 2-1/4 inches (57 mm) thick doors.
      c. Construction: Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
         1) Through-bolted anti-rotational studs.
      d. Cast stainless steel latch retractor with roller bearings for exceptionally smooth operation and superior strength and durability.
      e. Bored Hole: 2-1/8 inch (54 mm) diameter.
      f. Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
      g. Latch: Single piece tail-piece construction.
         1) Latchbolt Throw: 9/16 inch (14.3 mm), minimum.
      h. Cylinders:
         1) Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.

i. Lever Trim:
1) Style: See Door Hardware Schedule.
2) Outside Lever Sleeve: Seamless one-piece construction.

2. Electrified Locks: Same properties as standard locks, and as follows:
a. Function: Electrically locked (Fail Safe) or unlocked (Fail Secure), as indicated for each lock in Door Hardware Schedule.

C. Finishes: See Door Hardware Schedule.
1. Core Faces: Match finish of lockset.

D. Grades: Comply with BHMA A156.2, Grade 1, Series 4000, Operational Grade 1, Extra Heavy Duty.

E. Material: Manufacturer's standard for specified lock.

F. Products: Cylindrical locks, including mechanical and electrified types.
1. 9K (Grade 1).

2.11 DOOR PULLS AND PUSH PLATES

A. Manufacturers:
1. ABH.
2. Burns.
3. Trimco.

B. Material: Stainless steel, unless otherwise indicated.

2.12 LADDER PULLS

A. Manufacturers:
1. ABH
2. Trimco
3. Rockwood Manufacturing Company.

B. Properties:
1. Proper number of support fixings to accommodate length of pull as recommended by the manufacturer.

C. Installation:
1. Pull Handles Mounting Style: Use single-sided - SNG or back-to-back - B2B mounting methods, as appropriate for item specified and in coordination with door type and other hardware items.

2.13 CLOSERS

A. Manufacturers:
1. Dorma 8900 Series
2. LCN 4040XP Series.
3. Sargent 351 Series

B. Grades:
1. Closers: Comply with BHMA A156.4, Grade 1.
- Underwriters Laboratories Compliance:
a) Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.
- UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.

C. Installation:
1. Mounting: Includes surface mounted installations.
2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.

3. At outswinging exterior doors, mount closer on interior side of door.
4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

2.14 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
   1. Architectural Builders Hardware Mfg (ABH)
   2. Glynn Johnson
   3. Rixson

B. Sizes: Manufacturer's standard for the application.

C. Finishes:
   1. Arms and Brackets: Zinc-plated.

D. Grades: As applicable to item specified.
   1. Comply with BHMA A156.8, Grade 1.

E. Types:
   1. Surface-applied.
   2. Concealed.

2.15 PROTECTION PLATES

A. Manufacturers:
   1. ABH.
   2. Burns.
   3. Trimco.

B. Properties:
   1. Plates:
      - Kick Plates: Provide along bottom edge of push side of every wood door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
        a) Size: 10 inches (254 mm) high by 2 inch (51 mm) less door width (LDW) on push side of door.
      - Mop Plates: Provide along bottom edge of pull side of doors to provide protection from cleaning liquids and equipment damage to door surface.
      - Edges: Beveled, on four (4) unless otherwise indicated. CSK Screws.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.
   1. Metal Properties: Stainless steel.
      - Metal, Standard Duty: Thickness 0.050 inch (1.27 mm), minimum.

E. Installation:
   1. Fasteners: Countersunk screw fasteners

2.16 STOPS AND HOLDERS

A. Manufacturers:
   1. ABH.
   2. Burns.
   3. Trimco.

B. General: Provide overhead stop/holder when wall or floor stop is not feasible.

C. Grades:
   1. Door Holders, Wall Bumpers, and Floor Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

D. Types:

2.17 THRESHOLDS

A. Manufacturers:
   1. National Guard Products
   2. Pemko.
   3. Reese.

B. Properties:
   1. Threshold Surface: Fluted horizontal grooves across full width.

C. Grades: Thresholds: Comply with BHMA A156.21.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types: As applicable to project conditions. Provide barrier-free type at every location where specified.
   1. Saddle Thresholds: Without thermal break.
   2. Bumper Seal Thresholds with Gasket: Use silicone gaskets.

2.18 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
   1. National Guard Products, Inc: www.ngpinc.com/#sle.
   2. Pemko .
   3. Reese.

B. Products:
   1. Weatherstripping: See Door Hardware Schedule.
   2. Smoke Seals: See Door Hardware Schedule.
   3. Meeting Stile Seals: See Door Hardware Schedule.
   4. Door Bottom Seals:
      - Door Sweeps: See Door Hardware Schedule.

2.19 ELECTRIFIED HARDWARE

A. Manufacturers: Door Position Switch
   1. Dorma MC4
   2. Securitron DPS
   3. SDC MC-4

B. Properties:
   1. Door Position Switches: Recessed devices with magnetic contacts.
      - DPDT configuration.

2.20 KEYS AND CORES

A. Manufacturers:
   1. BEST, CORMAX Plus, No Substitution, Existing District System.

B. Properties: Complying with guidelines of BHMA A156.28.
   1. Provide small format interchangeable core.
   2. Provide interchangeable cores for all locks listed in the hardware spec by one supplier even if door supplied by different manufacturer.
   3. Provide Standard keys and cores.
   4. Stamp all keys “DO NOT DUPLICATE”
   5. Provide keying information in compliance with DHI (KSN) standards.

6. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
7. Keying: Master keyed.
8. Include construction keying and control keying with Brass removable core cylinders.
9. Supply keys in following quantities:
    - Grand Master Keys: 2 each.
    - Master Keys: 4 each each group.
    - Construction Master Keys: 4 each.
    - Construction Control Keys: 2 each.
    - Perm Core Control Keys: 4 each.
    - Change Keys: 2 each change keys for each keyed core.
10. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
11. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

2.21 KEY CABINETS

A. Manufacturers:
    1. Lund Equipment Company, Inc
    2. Telkee

B. Properties:.
    1. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.
    2. Security Key Tags: For each keyed lock on project, provide one set of matching key tags for permanent attachment to one key of each set.
    3. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
    4. Mounting: Wall surface mounted.
    5. CapacityActual quantity of keys, plus 50 percent additional capacity.
    6. Key cabinet lock to facility's keying system.

C. Finishes: Baked enamel, manufacturer's standard color.

D. Material: Sheet steel.

2.22 FINISHES

A. Finishes: Identified in Hardware Sets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Install hardware for smoke and draft control doors in accordance with NFPA 105.

E. Use templates provided by hardware item manufacturer.

F. Do not install surface mounted items until application of finishes to substrate are fully completed.

G. Wash down masonry walls and complete painting or staining of doors and frames.

H. Complete finish flooring prior to installation of thresholds.

I. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014000 - Quality Requirements.

3.04 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

Manufacturer list

ABH Architectural Builders
Hardware BES BEST
PRE BEST (Precision)
DKA dormakaba
Architectural NGP
National Guard
Products RCI
Rutherford
Controls Inc SPC
Special Lite

Finish list

Code:	Name:
689	Aluminum
AL	Anodized Aluminum
Clear	Latch
626	Chromium plated, satin
630	Satin Stainless Steel
600	Prime coat, gray

Specification Report Set #1 - Exterior - Alum

Doors: A2, A1

2.0	Continuous Hinge	661 HD UL	AL	BES
1.0	Removeable Mullion	SL-60 KR Special-Lite		SPC
1.0	Exit Device	2103 CD	630	PRE
1.0	Exit Device	2101 LD	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 C181 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
1.0	Pull	AB201 12" 12XHD Mtg	630	ABH
2.0	Door Closer	8916 SPA DP89 BSHD NFHD	689	DKA
2.0	Overhead Concealed Stop	1020SL Series	630	ABH
2.0	Door Position Switch	MC4		DKA
1.0	Drip Cap	16A DW + 4	A	NGP
2.0	Sweep	1015V		NGP
1.0	Threshold	8533 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Balance of weather-stripping by Aluminum Frame/Door manufacturer. Coordinate door hardware with Aluminum Frame/Door manufacturer. Set overhead stops degree to prevent doors hitting back to back.
Operation: Active leaf may be dogged down for push pull operation. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #2 - Secure Vestibule - Alum

Doors: A2A

2.0	Continuous Hinge	661 HD UL	AL	BES
1.0	Removeable Mullion	SL-60 KR Special-Lite		SPC
1.0	Exit Device	2103 CD	630	PRE
1.0	Exit Device	2101 LD	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 C181 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
1.0	Pull	AB201 12" 12XHD Mtg	630	ABH
2.0	Door Closer	8916 SPA DP89 BSHD NFHD	689	DKA
2.0	Overhead	1020SL Series	630	ABH

	Concealed Stop		
2.0	Door Position Switch	MC4	DKA

NOTE: Balance of weather-stripping by Aluminum Frame/Door manufacturer. Coordinate door hardware with Aluminum Frame/Door manufacturer. Set overhead stops degree to prevent doors hitting back to back.
Operation: Active leaf may be dogged down for push pull operation. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor. Coordinate

wiring and installation with GC / EC / Security Vendor.

Set #3 - Exterior - Alum - Card Access

Doors: A3

1.0	Continuous Hinge	661 HD UL	AL	BES
1.0	Exit Device	2103 CD	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
1.0	Pull	AB201 12" 12XHD Mtg	630	ABH
1.0	Electric Strike	0162LM	630	RCI
1.0	Door Closer	8916 SPA DP89 BSHD NFHD	689	DKA
1.0	Overhead Concealed Stop	1020SL Series	630	ABH
1.0	Card Reader	CARD READER BY SECURITY VENDOR		
1.0	Power Supply	POWER SUPPLY BY SECURITY VENDOR		
1.0	Wiring Diagram	Furnished by HWDE Supplier		
1.0	Door Position Switch	MC4		DKA
1.0	Drip Cap	16A DW + 4	A	NGP
1.0	Sweep	1015V		NGP
1.0	Threshold	8533 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Balance of weather-stripping by Aluminum Frame/Door manufacturer. Coordinate door hardware with Aluminum Frame/Door manufacturer. Set overhead stop degree to prevent doors hitting back to back.
Operation: Door normally closed and locked. Presentation of valid credential to card reader releases electric strike allowing authorized entry. Door may be dogged down for push pull operation. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #4 - Vestibule - Alum - Card Access

Doors: A3A

1.0	Continuous Hinge	661 HD UL	AL	BE

				S
1.0	Exit Device	2103 CD	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
1.0	Pull	AB201 12" 12XHD Mtg	630	ABH
1.0	Electric Strike	0162LM	630	RCI
1.0	Door Closer	8916 SPA DP89 BSHD NFHD	689	DKA
1.0	Overhead Concealed Stop	1020SL Series	630	ABH
1.0	Card Reader	CARD READER BY SECURITY VENDOR		
1.0	Power Supply	POWER SUPPLY BY SECURITY VENDOR		
1.0	Wiring Diagram	Furnished by HWDE Supplier		
1.0	Door Position Switch	MC4		DKA

NOTE: Balance of weather-stripping by Aluminum Frame/Door manufacturer. Coordinate door hardware with Aluminum Frame/Door manufacturer. Set overhead stop degree to prevent doors hitting back to back.
Operation: Door normally closed and locked. Presentation of valid credential to card reader releases electric strike allowing authorized entry. Door may be dogged down for push pull operation. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #5 - Recep - Alum - Card Access

Doors: A102A

1.0	Continuous Hinge	661 HD UL	AL	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Electric Strike	F2164 F2LM	630	RCI
1.0	Door Closer	8916 SPA DP89 BSHD NFHD	689	DKA
1.0	Wall Stop	AB400	626	ABH
1.0	Card Reader	CARD READER BY SECURITY VENDOR		
1.0	Power Supply	POWER SUPPLY BY SECURITY VENDOR		
1.0	Wiring Diagram	Furnished by HWDE Supplier		
1.0	Door Position Switch	MC4		DKA

NOTE: Balance of weather-stripping by Aluminum Frame/Door manufacturer. Coordinate door hardware with Aluminum Frame/Door manufacturer.
Operation: Door normally closed and locked. Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor.
Coordinate wiring and installation with GC / EC / Security Vendor.

Set #6 - Corr/Recep - Alum - Card Access

Doors: A102B

1.0	Continuous Hinge	661 HD UL	AL	BES
1.0	Intruder Lock	9K 3 7 IN 15 D S3 CORMAX Plus	626	BES
1.0	Electric Strike	F2164 F2LM	630	RCI
1.0	Door Closer	8916 SPA DP89 BSHD NFHD	689	DKA
1.0	Wall Stop	AB400	626	AB

			H
1.0	Card Reader	CARD READER BY SECURITY VENDOR	
1.0	Power Supply	POWER SUPPLY BY SECURITY VENDOR	
1.0	Wiring Diagram	Furnished by HWDE Supplier	
1.0	Door Position Switch	MC4	DK A

NOTE: Balance of weather-stripping by Aluminum Frame/Door manufacturer. Coordinate door hardware with Aluminum Frame/Door manufacturer.
Operation: Door normally closed and locked. Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor.
Coordinate wiring and installation with GC / EC / Security Vendor.

Set #7 - Corridor - Card Access

Doors: A102-3A

3.0	Hinge	FBB168 4.5x4.5 NRP	652	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Electric Strike	F2164 F2LM	630	RCI
1.0	Door Closer	8916 SPA	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Card Reader	CARD READER BY SECURITY VENDOR		
1.0	Power Supply	POWER SUPPLY BY SECURITY VENDOR		
1.0	Wiring Diagram	Furnished by HWDE Supplier		
1.0	Door Position Switch	MC4		DKA
1.0	Meeting Stile Astragal	5070CL		NGP

NOTE: Operation: Door normally closed and locked. Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #8 - Work Room - Card Access

Doors: A102-1B

3.0	Hinge	FBB168 4.5x4.5 NRP	652	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Electric Strike	F2164 F2LM	630	RCI
1.0	Door Closer	8916 DS	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Card Reader	CARD READER BY SECURITY VENDOR		
1.0	Power Supply	POWER SUPPLY BY SECURITY VENDOR		
1.0	Wiring Diagram	Furnished by HWDE Supplier		
1.0	Door Position	MC4		DK

	Switch			A
1.0	Gasketing	5020C @ Head & Jambs		NGP

NOTE: Operation: Door normally closed and locked. Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #9 - Exterior - Alum - Card Access

Doors: B1, B3, C1

2.0	Continuous Hinge	661 HD UL	AL	BES
1.0	Removeable Mullion	SL-60 KR E Special-Lite		SPC
1.0	Exit Device	2103 CD	630	PRE
1.0	Exit Device	2101 LD	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 C181 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
1.0	Pull	AB201 12" 12XHD Mtg	630	ABH
1.0	Electric Strike	0162LM	630	RCI
2.0	Door Closer	8916 SPA DP89 BSHD NFHD	689	DKA
2.0	Overhead Concealed Stop	1020SL Series	630	ABH
1.0	Card Reader	CARD READER BY SECURITY VENDOR		
1.0	Power Supply	POWER SUPPLY BY SECURITY VENDOR		
1.0	Wiring Diagram	Furnished by HWDE Supplier		
2.0	Door Position Switch	MC4		DKA
1.0	Drip Cap	16A DW + 4	A	NGP
2.0	Sweep	1015V		NGP
1.0	Threshold	8533 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Balance of weather-stripping by Aluminum Frame/Door manufacturer. Coordinate door hardware with Aluminum Frame/Door manufacturer.

Operation: Doors normally closed and locked. Presentation of valid credential to card reader releases active leaf electric strike allowing authorized entry. Active leaf may be dogged down for push pull operation. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #10 - Exterior - HM - Card Access

Doors: D3, D1, C3

2.0	Continuous Hinge	662 HD UL	AL	BES
1.0	Removeable Mullion	1340KR-EL	600	DKA
1.0	Exit Device	2103 CD 1703A	630	PRE
1.0	Exit Device	2101 LD	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
2.0	Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
1.0	Electric Strike	0162LM	630	RCI
2.0	Door Closer	8916 SDS	689	DKA
2.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Card Reader	CARD READER BY SECURITY VENDOR		
1.0	Power Supply	POWER SUPPLY BY SECURITY VENDOR		
1.0	Wiring Diagram	Furnished by HWDE Supplier		
2.0	Door Position Switch	MC4		DKA
1.0	Gasketing	5100N		NGP
1.0	Gasketing	700N @ Head & Jambs		NGP
1.0	Drip Cap	16A DW + 4	A	NGP
2.0	Sweep	1015V		NGP
1.0	Threshold	8533 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Operation: Doors normally closed and locked. Presentation of valid credential to card reader releases

active leaf electric strike allowing authorized entry. Active leaf may be dogged down for push pull operation. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #11 - Exterior - HM - Card Access

Doors: D2

1.0	Continuous Hinge	662 HD UL 83	AL	BES
1.0	Exit Device	2103 CD 1703A	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
1.0	Electric Strike	0162LM	630	RCI
1.0	Door Closer	8916 SDS	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Card Reader	CARD READER BY SECURITY VENDOR		
1.0	Power Supply	POWER SUPPLY BY SECURITY VENDOR		
1.0	Wiring Diagram	Furnished by HWDE Supplier		
1.0	Door Position Switch	MC4		DKA
1.0	Gasketing	700N @ Head & Jambs		NGP
1.0	Drip Cap	16A DW + 4	A	NGP
1.0	Sweep	1015V		NGP
1.0	Threshold	8533 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Operation: Door normally closed and locked. Presentation of valid credential to card reader releases electric strike allowing authorized entry. Door may be dogged down for push pull operation. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #12 - Vestibule

Doors: D3-1, C1-1

2.0	Continuous Hinge	662 HD UL	AL	BES
2.0	Dummy	671DR	630	PRE

	Touchbar			
1.0	Pull	AB201 12" 12XHD Mtg	630	ABH
2.0	Door Closer	8916 SDS	689	DKA
2.0	Kick Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Meeting Stile Astragal	5070CL		NGP
1.0	Gasketing	5020C @ Head & Jambs		NGP

NOTE: Verify model number for push and door pulls.

Set #13 - Exterior - HM - Exit Only

Doors: C101-3, C101-4

2.0	Continuous Hinge	662 HD UL	AL	BES
1.0	Removeable Mullion	KR822 MCS	689	PRE
2.0	Exit Device	2101 LD	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
2.0	Door Closer	8916 SDS	689	DKA
2.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
2.0	Door Position Switch	MC4		DKA
1.0	Gasketing	5100N		NGP
1.0	Gasketing	700N @ Head & Jambs		NGP
1.0	Drip Cap	16A DW + 4	A	NGP
2.0	Sweep	1015V		NGP
1.0	Threshold	8533 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Request to Exit by Security Vendor. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #14 - Gym

Doors: C103A, C103B

6.0	Hinge	FBB168 4.5x4.5 NRP	652	BES
1.0	Exit Device	2203 CD LBR 4903A	630	PRE
1.0	Exit Device	2201 LBR LD	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
2.0	Door Closer	8916 SDST	689	DKA
2.0	Kick Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
2.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
2.0	Wall Stop	AB400	626	ABH
1.0	Meeting Stile Astragal	5070CL		NGP
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #15 - Classroom, Nurse, Guidance

Doors: A105, A107, A113, A115, A119, A110, A112, A116, A106A, A108, A102-3B, B104, B105, B106, B107, B108, B113, B112, B114, B115, B116, B117, B100, D103-A, A203, A213, A215, A220, A221, A212, A214, A208, A207, B204, B205, B206, B207, B210, B213, B216, B217, B218, B219, B222, B224, D103-2

3.0	Hinge	FBB179 4.5X4.5 NRP	652	BES
1.0	Intruder Lock	9K 3 7 IN 15 D S3 CORMAX Plus	626	BES
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB403	626	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #16 - Classroom, Nurse Toilet

Doors: A108-2, A110-1, B106-1, B108-1, B105-1, B107-1, B114-1, B115-1, B116-1, B117-1, B104-1

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Privacy Set	9K 3 0 LL 15 D S3	626	BES
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB403	626	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #17 - Classroom Toilet

Doors: A105-1

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Privacy Set	9K 3 0 LL 15 D S3	626	BES
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Overhead Concealed Stop	1020SL Series	630	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #18 - Stair - Mag HO

Doors: ST-01-1, ST-03-1, ST-01-2, ST-02-2

6.0	Hinge	FBB168 4.5x4.5	652	BES
1.0	Exit Device	FL 2214 LBR 4914A	630	PRE
1.0	Exit Device	FL 2201 LBR	630	PRE
2.0	Door Closer	8916 SPA	689	DKA
2.0	Kick Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
2.0	Magnetic Door Holder	2100	689	ABH
1.0	Meeting Stile Astragal	5070CL		NGP
1.0	Gasketing	5020C @ Head & Jambs		NGP

NOTE: Operation: Doors normally held open by wall magnetic holders. In the event of power loss or activation of building fire alarm system doors close and latch. Tied into building fire alarm system. Free egress at all times. Wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #19 - Office

Doors: A102-4B, A102-7, A102-8, A108-1

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Office Lock	9K 3 7 AB 15 D S3 CORMAX Plus	626	BES

1.0	Wall Stop	AB403	626	ABH
3.0	Silencer	AB608-RKW	Clear	ABH

Set #20 - Guidance Office

Doors: A106B, A102-4A

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Office Lock	9K 3 7 AB 15 D S3 CORMAX Plus	626	BES
1.0	Wall Stop	AB403	626	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #21 - Closet

Doors: A102-5, A106-1

6.0	Hinge	FBB179 4.5X4.5	652	BES
2.0	Dummy Trim	9K DT 0 1DT 15 D	626	BES
2.0	Roller Latch	1892	630	ABH
2.0	Overhead Stop	9020 Series	630	ABH
2.0	Silencer	AB608-RKW	Clear	ABH

Set #22 - Storage, KILN

Doors: A102-2, A108-4, A208-1, A208-2, A202-1, B204-1

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Wall Stop	AB400	626	ABH
3.0	Silencer	AB608-RKW	Clear	ABH

Set #23 - Exam

Doors: A108-3

1.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Passage Set	9K 3 0 N 15 D S3	626	BES
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB400	626	ABH
3.0	Silencer	AB608-RKW	Clear	ABH

Set #24 - Toilet, Family Restroom, Lactation - VIBO

Doors: A102-6, A103, B103, B203, C102-4

1.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Mortise Lock - VIBO	45H 7 HJ 15 H VIB O_Option	626	BES
1.0	Door Closer	8916 AF89	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB400	626	ABH

1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #25 - Toilet - VIBO

Doors: A117, A217, A216, B221, B209

1.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Mortise Lock - VIBO	45H 7 HJ 15 H VIB O_Option	626	BES
1.0	Door Closer	8916 IS	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #26 - Storage

Doors: A107-1

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Overhead Stop	9020 Series	630	ABH
3.0	Silencer	AB608-RKW	Clear	ABH

Set #27 - Storage

Doors: A100, A114, A218, A219, B220, B223, B208, B211

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Door Closer	8916 IS	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
3.0	Silencer	AB608-RKW	Clear	ABH

Set #28 - Janitor, Storage, MR

Doors: A109, B110, A210, A100-1, B215

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Door Closer	8916 AF89	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB400	626	ABH
3.0	Silencer	AB608-RKW	Clear	ABH

Set #29 - Elec, IDF

Doors: A111, A209, A211, A206, A204, A204-1

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Door Closer	8916 AF89	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #30 - DE-ESC, Work Rm / IT Repair

Doors: A118, D101-1

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Intruder Lock	9K 3 7 IN 15 D S3 CORMAX Plus	626	BES
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Overhead Concealed Stop	1020SL Series	630	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #31 - Work Room

Doors: A102-1A

3.0	Hinge	FBB168 4.5x4.5	652	BES
1.0	Intruder Lock	9K 3 7 IN 15 D S3 CORMAX Plus	626	BES
1.0	Door Closer	8916 IS	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #32 - MDF - Card Access

Doors: A104

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Electric Strike	F2164 F2LM	630	RCI
1.0	Door Closer	8916 AF89	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Card Reader	CARD READER BY SECURITY VENDOR		

1.0	Power Supply	POWER SUPPLY BY SECURITY VENDOR	
1.0	Wiring Diagram	Furnished by HWDE Supplier	
1.0	Door Position Switch	MC4	DKA
1.0	Gasketing	5020C @ Head & Jambs	NGP

NOTE: Operation: Door normally closed and locked. Presentation of valid credential to card reader releases electric strike allowing authorized entry. Request to Exit by Security Vendor. Mechanical key override. Egress always allowed. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #33 - Closet

Doors: A102-9

6.0	Hinge	FBB179 4.5X4.5 NRP	652	BES
1.0	Flushbolt	1855S	626	ABH
1.0	Storeroom Lock	9K 3 7 D 15 D STK_7/8 CORMAX	626	BES
2.0	Wall Stop	AB400	626	ABH
2.0	Silencer	AB608-RKW	Clear	ABH

Set #34 - IDF, Elec

Doors: B109, B111, B212, B214

3.0	Hinge	FBB179 4.5X4.5 NRP	652	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Door Closer	8916 SDS	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #35 - LGI Classroom

Doors: B200A, B200B

3.0	Hinge	FBB168 4.5x4.5 NRP	652	BES
1.0	Exit Device	2103 CD 4903A	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
1.0	Door Closer	8916 SPA	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB400	626	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #36 - Music Room

Doors: A202

3.0	Hinge	FBB179 4.5X4.5 NRP	652	BES

1.0	Intruder Lock	9K 3 7 IN 15 D S3 CORMAX Plus	626	BES
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB403	626	ABH
1.0	Gasketing	5075 Head and jamb (2)		NGP
1.0	Gasketing	5060 Head and jamb (2)		NGP
2.0	Gasketing	60FP Frame Lower Corners		NGP
1.0	Door Shoe	12T6 x STC-FH		NGP
1.0	Threshold	8144 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Install gasketing per NGP seal set #4. Install threshold smooth side up. Coordinate hardware with door manufacturer.

Set #37 - Office

Doors: A205

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Office Lock	9K 3 7 AB 15 D S3 CORMAX Plus	626	BES
1.0	Overhead Concealed Stop	1020SL Series	630	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #38 - Instrumental, Platform

Doors: D100-A, D106

6.0	Hinge	FBB179 4.5X4.5 NRP	652	BES
1.0	Flushbolt	1855S	626	ABH
1.0	Intruder Lock	9K 3 7 IN 15 D S3-7/8 CORMAX	626	BES
2.0	Kick Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
2.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
2.0	Wall Stop	AB403	626	ABH
1.0	Gasketing	5075 Head and jamb (2)		NGP
1.0	Gasketing	5060 Head and jamb (2)		NGP
2.0	Gasketing	5060 Inactive Door 2 Rows		NGP
3.0	Gasketing	60FP Frame Lower Corners x Inact Leaf Lower		NGP
2.0	Door Shoe	12T6 x STC-FH		NGP
1.0	Threshold	8144 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Install gasketing per NGP seal set #8. Install threshold smooth side up. Coordinate hardware with door manufacturer.

Set #39 - Music Pract

Doors: D104-A

3.0	Hinge	FBB179 4.5X4.5	652	BES

1.0	Intruder Lock	9K 3 7 IN 15 D S3 CORMAX Plus	626	BES
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB403	626	ABH
1.0	Gasketing	5075 Head and jamb (2)		NGP
1.0	Gasketing	5060 Head and jamb (2)		NGP
2.0	Gasketing	60FP Frame Lower Corners		NGP
1.0	Door Shoe	12T6 x STC-FH		NGP
1.0	Threshold	8144 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Install gasketing per NGP seal set #4. Install threshold smooth side up. Coordinate hardware with door manufacturer.

Set #40 - Music Pract

Doors: D104-B, D104-C

3.0	Hinge	FBB179 4.5X4.5 NRP	652	BES
1.0	Classroom Lock	9K 3 7 R 15 D S3 CORMAX	626	BES
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Overhead Concealed Stop	1020SL Series	630	ABH
1.0	Gasketing	5075 Head and jamb (2)		NGP
1.0	Gasketing	5060 Head and jamb (2)		NGP
2.0	Gasketing	60FP Frame Lower Corners		NGP
1.0	Door Shoe	12T6 x STC-FH		NGP
1.0	Threshold	8144 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Install gasketing per NGP seal set #4. Install threshold smooth side up. Coordinate hardware with door manufacturer.

Set #41 - Media Center - Alum

Doors: D101

2.0	Continuous Hinge	661 HD UL	AL	BES
1.0	Exit Device	2803 CD LBR 4903A	630	PRE
1.0	Exit Device	2801 LD LBR	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0	Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
1.0	Door Closer	8916 SDS DP89 BSHD NFHD	689	DKA
1.0	Door Closer	8916 SPA DP89 BSHD NFHD	689	DKA
1.0	Wall Stop	AB400	626	ABH

NOTE: Balance of weather-stripping by Aluminum Frame/Door manufacturer. Coordinate door hardware with Aluminum Frame/Door manufacturer.

Set #42 - Emerg Elec, Mech Mezz

Doors: D105-2, D201

3.0	Hinge	FBB179 4.5X4.5 NRP	652	BES
1.0	Exit Device	FL 2103 4903A	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0	Door Closer	8916 SDS	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #43 - Receiving, HVAC / Boilers / Storage

Doors: D105, D105-1

6.0	Hinge	FBB168 4.5x4.5 NRP	652	BES
1.0	Exit Device	FL 2203 LBR 4903A	630	PRE
1.0	Exit Device	FL 2201 LBR	630	PRE
1.0	Rim Cylinder	12E7 2 CORMAX Plus	626	BES
2.0	Door Closer	8916 SPA	689	DKA
2.0	Kick Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
2.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
2.0	Wall Stop	AB400	626	ABH
1.0	Meeting Stile Astragal	5070CL		NGP
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #44 - Storage

Doors: D100

6.0	Hinge	FBB168 5x4.5 NRP	652	BES
1.0	Flushbolt	1855S	626	ABH
1.0	Storeroom Lock	9K 3 7 D 15 D STK_7/8 CORMAX	626	BES
2.0	Overhead Stop	9020 Series	630	ABH
2.0	Kick Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
2.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Meeting Stile Astragal	5070CL		NGP
2.0	Silencer	AB608-RKW	Clear	ABH

Set #45 - Gate

Doors: GA-1A, GA-1B

1.0	Padlock	41B 7 22 CORMAX Plus	626	BES

Set #46 - Gym Storage, Storage, Kitchen

Doors: B102, C103-4A, C103-4B, C103-2, C101-2

6.0	Hinge	FBB179 4.5X4.5 NRP	652	BES
1.0	Flushbolt	1855S	626	ABH
1.0	Storeroom Lock	9K 3 7 D 15 D STK_7/8 CORMAX	626	BES
2.0	Overhead Stop	9020 Series	630	ABH
1.0	Meeting Stile Astragal	5070CL		NGP
2.0	Silencer	AB608-RKW	Clear	ABH

Set #47 - Gym Office

Doors: C103-1

3.0	Hinge	FBB179 4.5X4.5 NRP	652	BES
1.0	Office Lock	9K 3 7 AB 15 D S3 CORMAX Plus	626	BES
1.0	Door Closer	8916 SDS	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #48 - AV Closet

Doors: C101-1

3.0	Hinge	FBB179 4.5X4.5 NRP	652	BES
1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
3.0	Silencer	AB608-RKW	Clear	ABH

Set #49 - Kitchen Office

Doors: C102-2

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Office Lock	9K 3 7 AB 15 D S3 CORMAX Plus	626	BES
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB403	626	ABH
3.0	Silencer	AB608-RKW	Clear	ABH

Set #50 - Dry Storage

Doors: C102-3, C102-4

3.0 Hinge	FBB179 4.5X4.5	652	BES
1.0 Classroom Lock	9K 3 7 R 15 D S3 CORMAX	626	BES
1.0 Armor Plate	PP0050 30" X DW - 1" B4E CSK	630	ABH
1.0 Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0 Wall Stop	AB400	626	ABH
1.0 Sweep	OV634A		NGP
1.0 Gasketing	5020C @ Head & Jambs		NGP

Set #51 - Overhead Door, Emerg Grille

Doors: EG-02, D100-C, EG-03, EG-04, C102-1, C102B, EG-01, OD-1

1.0 Rim Cylinder	1E / 12E7 CORMAX Plus as Req'd	626

BES NOTE: Balance of hardware by sliding door manufacturer. Provide cylinder as required.

Set #52 - Cafeteria - Alum

Doors: C101

2.0 Continuous Hinge	661 HD UL	AL	BES
1.0 Exit Device	2803 CD LBR 4903A	630	PRE
1.0 Exit Device	2801 LD LBR	630	PRE
1.0 Rim Cylinder	12E7 2 CORMAX Plus	626	BES
1.0 Mortise Cylinder	1E7 4 CORMAX Plus	626	BES
2.0 Door Closer	8916 SDS DP89 BSHD NFHD	689	DKA

NOTE: Balance of weather-stripping by Aluminum Frame/Door manufacturer. Coordinate door hardware with Aluminum Frame/Door manufacturer.

Set #53 - Kitchen / Cafe

Doors: C102A

3.0 Hinge	FBB168 4.5x4.5 NRP	652	BES
1.0 Mortise Deadlock	48H 7 K CORMAX Plus	626	BES
1.0 Push Plate	AB70E	630	ABH
1.0 Pull Plate	AB126_X_AB70C	630	ABH
1.0 Door Closer	8916 AF89	689	DKA
1.0 Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0 Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0 Wall Stop	AB400	626	ABH
3.0 Silencer	AB608-RKW	Clear	ABH

NOTE: Mount deadlock @ 36" AFF below push / pull.

Set #54 - Closet

Doors: C100-1

3.0	Hinge	FBB179 4.5X4.5 NRP	652	BES

1.0	Storeroom Lock	9K 3 7 D 15 D S3 CORMAX Plus	626	BES
1.0	Wall Stop	AB400	626	ABH
3.0	Silencer	AB608-RKW	Clear	ABH

Set #55 - Staff Room

Doors: C100

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Intruder Lock	9K 3 7 IN 15 D S3 CORMAX Plus	626	BES
1.0	Door Closer	8916 AF89	689	DKA
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Wall Stop	AB403	626	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Set #56 - Ext Media Center - Alum - Exit Only

Doors: C2

1.0	Continuous Hinge	661 HD UL	AL	BES
1.0	Exit Device	2101 LD	630	PRE
1.0	Door Closer	8916 SDS DP89 BSHD NFHD	689	DKA
1.0	Overhead Concealed Stop	1020SL Series	630	ABH
1.0	Door Position Switch	MC4		DKA
1.0	Drip Cap	16A DW + 4	A	NGP
1.0	Sweep	1015V		NGP
1.0	Threshold	8533 SIA LAR 1/4-20_SS_MS/EA		NGP

NOTE: Balance of weather-stripping by Aluminum Frame/Door manufacturer. Coordinate door hardware with Aluminum Frame/Door manufacturer. Request to Exit by Security Vendor. All wiring and conduit by electrical contractor. Coordinate wiring and installation with GC / EC / Security Vendor.

Set #57 - Folding Partition

Doors: B200C, C103C, D100-B

NOTE: All hardware by sliding door manufacturer.

Set #58 - Gate

Doors: GA-2A, GA-2B

1.0	Rim Cylinder	1E / 12E7 CORMAX Plus as Req'd	626

BES NOTE: Balance of hardware by Gate

manufacturer. Cylinder as required.

Set #59 – Locker Room

Doors: C102-6

3.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Classroom Lock	9K 3 7 R 15 D S3 CORMAX Plus	626	BES
1.0	Door Closer	8916 IS	689	DKA
1.0	Overhead Stop	9020 Series x 90541 pull side Mtg Brk	630	ABH
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
3.0	Silencer	AB608-RKW	Clear	ABH

Set #60 - Toilet- VIBE O Indicator

Doors: C102-6A

1.0	Hinge	FBB179 4.5X4.5	652	BES
1.0	Mortise Lock - VIBO	45H 0 LT 15 H VIBE O_Option	626	BES
1.0	Overhead Stop	9020 Series x 90541 pull side Mtg Brk	630	ABH
1.0	Kick Plate	PP0050 10" X DW - 2" B4E CSK	630	ABH
1.0	Mop Plate	PP0050 10" X DW - 1" B4E CSK	630	ABH
1.0	Gasketing	5020C @ Head & Jambs		NGP

Opening List

Opening: Hardware Set Assignment:

A1	1 - Exterior - Alum
A2	1 - Exterior - Alum

A2A	2 - Secure Vestibule - Alum
A3	3 - Exterior - Alum - Card Access
A3A	4 - Vestibule - Alum - Card Access
A100	27 - Storage
A102-1A	31 - Work Room
A102-1B	8 - Work Room - Card Access
A102-2	22 - Storage, KILN
A102-3A	7 - Corridor - Card Access
A102-3B	15 - Classroom, Nurse, Guidance
A102-4A	20 - Guidance Office
A102-4B	19 - Office
A102-5	21 - Closet
A102-6	24 - Toilet, Family Restroom, Lactation - VIBO
A102-7	19 - Office
A102-8	19 - Office
A102-9	33 - Closet
A102A	5 - Recep - Alum - Card Access
A102B	6 - Corr/Recep - Alum - Card Access
A103	24 - Toilet, Family Restroom, Lactation - VIBO
A104	32 - MDF - Card Access
A105	15 - Classroom, Nurse, Guidance
A105-1	17 - Classroom Toilet
A106-1	21 - Closet
A106A	15 - Classroom, Nurse, Guidance
A106B	20 - Guidance Office
A107	15 - Classroom, Nurse, Guidance
A107-1	26 - Storage
A108	15 - Classroom, Nurse, Guidance
A108-1	19 - Office
A108-2	16 - Classroom, Nurse Toilet
A108-3	23 - Exam
A108-4	22 - Storage, KILN
A109	28 - Janitor, Storage, MR
A110	15 - Classroom, Nurse, Guidance
A110-1	16 - Classroom, Nurse Toilet
A111	29 - Elec, IDF
A112	15 - Classroom, Nurse, Guidance
A113	15 - Classroom, Nurse, Guidance
A114	27 - Storage
A115	15 - Classroom, Nurse, Guidance
A116	15 - Classroom, Nurse, Guidance
A117	25 - Toilet - VIBO
A118	30 - DE-ESC, Work Rm / IT Repair
A119	15 - Classroom, Nurse, Guidance
B1	9 - Exterior - Alum - Card Access
B3	9 - Exterior - Alum - Card Access
B100	15 - Classroom, Nurse, Guidance

B103	24 - Toilet, Family Restroom, Lactation - VIBO
B104	15 - Classroom, Nurse, Guidance
B104-1	16 - Classroom, Nurse Toilet
B105	15 - Classroom, Nurse, Guidance
B105-1	16 - Classroom, Nurse Toilet
B106	15 - Classroom, Nurse, Guidance
B106-1	16 - Classroom, Nurse Toilet
B107	15 - Classroom, Nurse, Guidance
B107-1	16 - Classroom, Nurse Toilet
B108	15 - Classroom, Nurse, Guidance
B108-1	16 - Classroom, Nurse Toilet
B109	34 - IDF, Elec
B110	28 - Janitor, Storage, MR
B111	34 - IDF, Elec
B112	15 - Classroom, Nurse, Guidance
B113	15 - Classroom, Nurse, Guidance
B114	15 - Classroom, Nurse, Guidance
B114-1	16 - Classroom, Nurse Toilet
B115	15 - Classroom, Nurse, Guidance
B115-1	16 - Classroom, Nurse Toilet
B116	15 - Classroom, Nurse, Guidance
B116-1	16 - Classroom, Nurse Toilet
B117	15 - Classroom, Nurse, Guidance
B117-1	16 - Classroom, Nurse Toilet
C1	9 - Exterior - Alum - Card Access
C1-1	12 - Vestibule
C2	56 - Ext Media Center - Alum - Exit Only
C3	10 - Exterior - HM - Card Access
C100	55 - Staff Room
C100-1	54 - Closet
C101	52 - Cafeteria - Alum
C101-1	48 - AV Closet
C101-2	46 - Gym Storage, Storage
C101-3	13 - Exterior - HM - Exit Only
C101-4	13 - Exterior - HM - Exit Only
C102-1	51 - Overhead Door, Energ Grille
C102-2	49 - Kitchen Office
C102-3	50 – Dry Storage
C102-4	50 – Dry Storage
C102-6	59 – Lockers
C102-6A	50 - Toilet
C102A	53 - Kitchen / Cafe
C102B	51 - Overhead Door, Energ Grille
C103-1	46 - KitchjenC103-2
C103-2	46 - Gym
C103-4A	46 - Gym Storage, Storage
C103-4B	46 - Gym Storage, Storage

C103B	14 - Gym
C103C	57 - Folding Partition
D1	10 - Exterior - HM - Card Access
D2	11 - Exterior - HM - Card Access
D3	10 - Exterior - HM - Card Access
D3-1	12 - Vestibule
D100	44 - Storage
D100-A	38 - Instrumental, Platform
D100-B	57 - Folding Partition
D100-C	51 - Overhead Door, Energ Grille
D101	41 - Media Center - Alum
D101-1	30 - DE-ESC, Work Rm / IT Repair
D103-2	15 - Classroom, Nurse, Guidance
D103-A	15 - Classroom, Nurse, Guidance
D104-A	39 - Music Pract
D104-B	40 - Music Pract
D104-C	40 - Music Pract
D105	43 - Receiving, HVAC / Boilers / Storage
D106	38 - Instrumental, Platform
EG-01	51 - Overhead Door, Energ Grille
EG-02	51 - Overhead Door, Energ Grille
GA-1A	45 - Gate
GA-1B	45 - Gate
GA-2A	58 - Gate
GA-2B	58 - Gate
OD-1	51 - Overhead Door, Energ Grille
ST-01-1	18 - Stair - Mag HO
ST-03-1	18 - Stair - Mag HO
A202	36 - Music Room
A202-1	22 - Storage, KILN
A203	15 - Classroom, Nurse, Guidance
A204	29 - Elec, IDF
A204-1	29 - Elec, IDF
A205	37 - Office
A206	29 - Elec, IDF
A208	15 - Classroom, Nurse, Guidance
A208-1	22 - Storage, KILN
A208-2	22 - Storage, KILN
A209	29 - Elec, IDF
A210	28 - Janitor, Storage, MR
A211	29 - Elec, IDF
A212	15 - Classroom, Nurse, Guidance
A213	15 - Classroom, Nurse, Guidance
A214	15 - Classroom, Nurse, Guidance
A215	15 - Classroom, Nurse, Guidance
A216	25 - Toilet - VIBO
A217	25 - Toilet - VIBO

A218	27 - Storage
A219	27 - Storage
A220	15 - Classroom, Nurse, Guidance
A221	15 - Classroom, Nurse, Guidance
B200A	35 - LGI Classroom
B200B	35 - LGI Classroom
B200C	57 - Folding Partition
B203	24 - Toilet, Family Restroom, Lactation - VIBO
B204	15 - Classroom, Nurse, Guidance
B204-1	22 - Storage, KILN
B205	15 - Classroom, Nurse, Guidance
B206	15 - Classroom, Nurse, Guidance
B207	15 - Classroom, Nurse, Guidance
B208	27 - Storage
B209	25 - Toilet - VIBO
B210	15 - Classroom, Nurse, Guidance
B211	27 - Storage
B212	34 - IDF, Elec
B213	15 - Classroom, Nurse, Guidance
B214	34 - IDF, Elec
B215	28 - Janitor, Storage, MR
B216	15 - Classroom, Nurse, Guidance
B217	15 - Classroom, Nurse, Guidance
B218	15 - Classroom, Nurse, Guidance
B219	15 - Classroom, Nurse, Guidance
B220	27 - Storage
B221	25 - Toilet - VIBO
B222	15 - Classroom, Nurse, Guidance
B223	27 - Storage
B224	15 - Classroom, Nurse, Guidance
D201	42 - Emerg Elec, Mech Mezz
EG-03	51 - Overhead Door, Emerg Grille
EG-04	51 - Overhead Door, Emerg Grille
ST-01-2	18 - Stair - Mag HO
ST-02-2	18 - Stair - Mag HO
A207	15 - Classroom, Nurse, Guidance
A100-1	28 - Janitor, Storage, MR
B102	46 - Gym Storage, Storage
D105-2	42 - Emerg Elec, Mech Mezz
D105-1	43 - Receiving, HVAC / Boilers / Storage
C103A	14 - Gym

SECTION 08 80 00 - 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. Division 06 Section “Interior Architectural Woodwork” for glazing in custom fabrications.
2. Division 08 Section “Aluminum –Framed Entrances and Storefronts”
3. Division 08 Section “Glazed Aluminum Curtain Walls”
4. Division 08 Section “Security Glazing”

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. Doors.
2. Glazed curtain walls.
3. Storefront framing.
4. Glazed entrances.
5. 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.
D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.
F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

   a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

   b. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7.0, "Snow Loads."

   c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.

      1) Load Duration: 60 seconds or less .

   d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.

      1) Load Duration: 30 days.

   e. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.

      1) For monolithic-glass lites heat treated to resist wind loads.
      2) For insulating glass.
      3) For laminated-glass lites.

   f. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

g. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. 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; 180 deg F (100 deg C), material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to 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. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
   b. Solar Heat Gain Coefficient: NFRC 200.
   c. Solar Optical Properties: NFRC 300.

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. 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.

G. 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. Basis of Design: Vitro Architectural Glass Solarban 70
B. 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.

C. 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.

D. 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. Provide Clear Laminated Insulating Low-E-Glass “LIG” on all windows, storefronts, curtainwalls and doors on first floor up to 10’ above grade.
D. TYPES

1. Clear Tempered Glass: Indicated on Drawings as "**CT**"

   a. glass; ¼ inch thick, clear tempered glass;
   b. Provide "Tempered Glass" by VITRO ARCHITECTURAL GLASS, Guardian; or equal products of alternatives of the quality necessary to meet the specifications
   c. Provide where indicated on the Drawings

2. Clear Insulating Low-E Glass: Indicated on Drawings as “**CIG**”

   a. consisting of an exterior side of 1/4” clear glass and an interior side of 1/4” clear glass.
   b. Glass shall be separated by a spacer and be hermetically sealed using double seal organic sealants.
   c. Low E coating on #2 surface.
   d. Unit thickness including ½-inch air space shall total 1 inch.
   e. Provide “Solorban 70 - Clear” by VITRO ARCHITECTURAL GLASS; or “Sun-Guard SN-68” by Guardian; or equal products of alternatives of the quality necessary to meet the specifications.
   f. Provide at locations indicated except where safety glass is required by CPSC 16 CFR 1201;

3. Clear Insulating Tempered Low-E Glass: Indicated on Drawings as “**CIT**”

   a. exterior side of 1/4” clear tempered glass
   b. interior side of 1/4” clear tempered glass.

c. Glass shall be separated by a spacer and be hermetically sealed using double seal organic sealants.
d. Unit thickness including ½-inch air space shall total 1 inch.
e. Low-E Coating on #2 surface.
f. Provide “Solorban 70 - Clear” by VITRO ARCHITECTURAL GLASS; or equal products of alternatives of the quality necessary to meet the specifications.
g. Provide in Curtainwall and/or Storefront System where safety glass is required by CPSC 16 CFR 1201.

4. Insulating Glass Spandrel: Indicated on Drawings as “**SP**”

a. exterior side of 1/4 inch tinted tempered glass
b. interior side of spandrelite glass fourth surface.
c. Glass separated by a spacer and hermetically sealed using double seal organic sealants.
d. Unit thickness including 1/2-inch air space shall total 1 inch.
e. "OPACI-COAT-300®" by VITRO ARCHITECTURAL GLASS, or alternatives of the quality necessary to meet the specifications.

5. Clear Glass: Indicated on Drawings as “**CG**”

a. ¼ inch thick ultra-clear glass, VLT: 90 percent
b. U-Value Winter 1.02
c. U-Value Summer 0.93
d. SHGC .90
e. Shading Coefficient 1.03
f. Visible Light reflectance 8 percent.
g. Provide “Starphire” by VITRO ARCHITECTURAL GLASS; or equal products of alternatives of the quality necessary to meet the specifications

6. Specially Tempered Monolithic Glass: Indicated on Drawings as “**FRG**”

a. Proprietary Category II safety glazing product in the form of a specially tempered 1/4-inch- (6.4-mm-) thick monolithic lite, and as follows:

1) Fire-Protection Rating: 20 minutes, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
2) Basis of Design Product: Subject to compliance with requirements, “FireGlass20” as manufactured by J. R. Four Ltd., and distributed by Technical Glass Products or a comparable product by one of the following:.

a) “SuperLite20” by SAFTIFIRST.
b) AGC InterEdge, Technologies., ; PyroEdge-20.

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. 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.

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 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 80 00

SECTION 08 88 53 - SECURITY GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glass-clad polycarbonate and insulating security glazing for the following applications:
   1. Doors.
   2. Storefront framing.
   3. Interior borrowed lites.

B. Related Sections include the following:
   1. Division 08 Section “Glazing”: Non-security glazing types including clear float glass lites incorporated as part of insulated security glazing assemblies.
   2. Division 08 Sections “Aluminum-Framed Entrances and Storefronts” and “Glazed Aluminum Curtain Walls”.

1.2 DEFINITIONS

A. Glazing Manufacturers: Firms that produce primary glass or fabricated security glazing, as defined in referenced glazing publications.
B. Interspace: Space between lites of insulating security glazing.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for security glazing during and after installation.

1.5 SUBMITTALS

A. Product Data: For each type of product.
B. Security Glazing Samples: For each type of security glazing; 12 inches square.

C. Glazing Accessory Samples: For sealants, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
D. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.
E. Qualification Data: For installers, manufacturers of insulating security glazing with sputter-coated, low-e coatings and glazing testing agency.
F. Product Certificates: For each type of product indicated, from manufacturer.
G. Product Test Reports: For each type of security glazing, for tests performed by manufacturer and witnessed by a qualified testing agency.
H. Product Test Reports: For each type of glazing sealant, for tests performed by a qualified testing agency.
    1. Provide test reports based on testing current sealant formulations within previous 36-month period.

I. Preconstruction adhesion and compatibility test reports.
J. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.
B. Sealant Testing Agency Qualifications: Qualified according to ASTM C 1021 for testing indicated.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each security glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
    1. Testing will not be required if data based on previous testing of current sealant products and glazing materials match those submitted.
    2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to security glazing, tape sealants, gaskets, and glazing channel substrates.
    3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
    4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
    5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.
B. Comply with insulating security glazing manufacturers' written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD 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.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Laminated Glass and Polycarbonate: Manufacturer agrees to replace laminated glass and polycarbonate that deteriorates within specified warranty period. Deterioration of laminated glass and polycarbonate is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass and polycarbonate contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Security Glazing: Obtain security glazing from single source from single manufacturer using the same types of lites, plies, interlayers, and spacers for each security glazing type indicated.
B. Source Limitations for Glazing Sealants and Gaskets: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General:

   1. Installed security glazing shall withstand normal thermal movement and wind loads without failure, including loss or breakage attributable to the following: defective

manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing; or other defects in construction.

2. Installed security glazing shall withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated.

1. Design Procedure for Glass: ASTM E 1300 and ICC's International Building Code.
2. Design Wind Pressures: For exterior security glazing, as indicated on Drawings.
3. Forced-Entry Resistance: Class 1.3 according to ASTM F1233.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glazing framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 SECURITY GLAZING, GENERAL

A. Glazing Publications: Comply with published recommendations of security glazing and glazing material 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: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.

C. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council. Label shall indicate manufacturer's name, type of glazing, glass thickness, and safety glazing standard with which glazing complies.

D. Fire-Test-Response Characteristics of Polycarbonate Sheets: As determined by testing polycarbonate sheets identical to those used in security glazing products by a qualified testing agency acceptable to authorities having jurisdiction.
1. Self-ignition temperature of 650 deg F or more when tested according to ASTM D 1929 on plastic sheets in thicknesses indicated for the Work.
2. Smoke-Developed Index of 450 or less when tested according to ASTM E 84, or smoke density of 75 or less when tested according to ASTM D 2843 on plastic sheets in thicknesses indicated for the Work.
3. Burning extent of 1 inch or less when tested according to ASTM D 635 at a nominal thickness of 0.060 inch or thickness indicated for the Work.

2.4 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For heat-strengthened float glass, comply with requirements for Kind HS.
3. For fully tempered float glass, comply with requirements for Kind FT.
4. For uncoated glass, comply with requirements for Condition A.
5. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.5 POLYCARBONATE SECURITY GLAZING

A. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on exposed surfaces and Type I, standard, UV-stabilized polycarbonate where no surfaces are exposed.
B. Glass-Clad Polycarbonate: ASTM C 1349.

2.6 INSULATING SECURITY GLAZING

A. Insulating Security Glazing: Factory-assembled units, consisting of sealed lites of glazing material indicated separated by a dehydrated interspace, qualified according to ASTM E 2190.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. 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.

C. Security Sealant: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement complying with ASTM C 920, Grade NS, Class 12.5 or 25, Use NT, and with a Shore A hardness of at least 45 when tested according to ASTM C 661.

2.8 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 security glazing manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   2. 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.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of security glazing 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 security glazing manufacturer to maintain security glazing lites in place for installation indicated.
E. Edge Blocks: Elastomeric material of hardness needed to limit security glazing 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.

2.10 FABRICATION OF SECURITY GLAZING

A. Fabricate security glazing 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. Grind smooth and polish exposed security glazing edges and corners.

2.11 SECURITY GLASS UNITS

A. Security Glazing Type SG: Clear symmetrical glass-clad polycarbonate with both exposed surfaces of clear float glass.
   1. Basis-of-Design Product: Global Security Glazing, Inc.; Childguard Security Glazing.
   2. Comparable Products: Subject to compliance with requirements, provide the basis-of-design product indicated or a comparable product by one of the following:
      a. LTI Smart Glass Inc.; School Guard Glass
   3. Forced-Entry Resistance: Class 1.3 according to ASTM F1233.
   4. Overall Unit Thickness: 3/8 inch
   5. Kind FT (fully tempered).
   6. Core: Manufacturer's standard polycarbonate.
   7. Overall Visible Light Transmittance: .77 percent minimum.
   8. Provide safety glazing labeling.

2.12 INSULATING SECURITY GLASS UNITS

A. Security Glazing Type ISG: Clear insulating security glazing with monolithic glass outdoor lite and glass-clad polycarbonate indoor lite.
   1. Basis-of-Design Product: Global Security Glazing, Inc.; Childguard Security Glazing.
   2. Comparable Products: Subject to compliance with requirements, provide the basis-of-design product indicated or a comparable product by one of the following:
      a. LTI Smart Glass Inc.; School Guard Glass.
   1. Forced-Entry Resistance: Class 1.3 according to ASTM F1233.
   2. Overall Unit Thickness: 1-inch nominal.
   3. Outdoor Lite: Class 1 (clear) float glass, Vitro Architectural Glass; Solarban 60 Solar Control Low-E or comparable product.
      a. Kind FT (fully tempered).
   4. Indoor Lite: Glass-clad polycarbonate.
      a. Outer and inner glass plies: Class 1 (clear) float glass 3/8".
         1) Kind FT (fully tempered).
      b. Core: Manufacturer's standard polycarbonate.
   5. Interspace Content: Air.
   6. Low-E Coating: Sputtered on second surface.
   7. Visible Light Transmittance: 68-70 percent.
   8. Winter Nighttime U-Factor: 0.29 maximum.
   9. Summer Daytime U-Factor: 0.28 maximum.
   10. Solar Heat Gain Coefficient: 0.38 maximum.
   11. Outdoor Visible Reflectance: 0.11 percent maximum.
   12. Shading Coefficient: 0.44
   13. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing for security glazing, 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 system.
3. Minimum required face or edge clearances.
4. Minimum required bite.
5. Effective sealing between joints of 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 security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.
B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.
C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.
F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches.
    1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. 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 performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.
H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.
I. Set coated security glazing with proper orientation so that coatings and films face exterior or interior as specified.
J. 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.
K. 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 security glazing, 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 just before each glazing unit is installed.
F. Apply heel bead of elastomeric sealant.
G. Center security glazing 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. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
B. Insert soft compression gasket securely in place between glazing unit 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 security glazing 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 security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center security glazing 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 security glazing. 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 security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. 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 security glazing and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial washaway from security glazing.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. 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.

1. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.

C. Wash security glazing 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 security glazing as recommended in writing by security glazing manufacturer.

END OF SECTION 08 88 53

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Interior gypsum wallboard, including abuse-resistant gypsum board.
2. Tile backing panels.
3. Non-load-bearing steel framing for gypsum board assemblies, interior gypsum board soffits, and exterior fiber cement board soffits.
4. Special corner finishing units for gypsum board assemblies, designed to bond structurally with gypsum panels to prevent cracks.
5. Sound attenuation blankets and acoustical sealant for gypsum board assemblies.
6. Installation of access panels in gypsum board assemblies.

B. Related Sections include the following:
1. Division 05 Section "Cold-Formed Metal Framing": Steel framing for exterior walls, roofs and other conditions.
2. Division 06 Section "Rough Carpentry": Wood blocking for support of wall-mounted items; and gypsum wallboard used as underlayment for interior raised platform construction.
3. Division 06 Section “Sheathing": Installations over steel framing.
4. Division 07 Section "Firestopping": Firestopping.
5. Division 07 Section "Fire-Resistive Joint Systems": Fire-resistance-rated joint sealants.
6. Division 09 Section "Tiling": Mortar applied over cementitious backer units.

1.2 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide non-load-bearing gypsum board wall and partition assemblies capable of withstanding uniform load of 5 lbf/sq. ft. over entire wall for heights of partitions indicated without failing.
1. Deflection Limit: L/360, unless otherwise indicated; L/600 for gypsum board assemblies with ceramic tile facing.
2. Provide framing member size, thickness and spacing, and supplemental bracing as necessary to comply with manufacturer's published recommendations for conditions of installation and performance requirements.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
C. 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.
D. Samples: For the following products:
   1. Trim Accessories: Full-size sample in 12-inch-long length for each trim accessory indicated.

1.5 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."
   2. Construct fire-resistance rated partitions in compliance with tested assembly requirements indicated on Drawings.
   3. Rated assemblies to be substantiated from applicable testing using proposed products, by Contractor.

1.6 PRODUCT 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 damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.
C. Protect cold-formed framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI’s “Code of Standard Practice”.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Steel Framing and Furring:
      a. Consolidated Systems, Inc.
      b. ClarkDietrich Building Systems.
      c. Marino\WARE.
   2. Gypsum Board and Related Products:
      a. G-P Gypsum Corp.
      b. National Gypsum Company.

c. United States Gypsum Co.
d. Lafarge, North America, Inc.

3. Special Corner Finishing Units:
   a. No-Coat; distributed by Grabber Construction Products, (888) 662-6281.

2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Contractor's Option: Use framing or grid suspension system as specified in this Article.
B. Components, General: Comply with ASTM C 645 for conditions indicated.
C. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
D. Hangers: Wire hangers; ASTM A 641, Class 1 zinc coating, soft temper, 0.162-inch diameter.
E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base steel thickness of 0.0538 inch, a minimum 1/2-inch-wide flange, with ASTM A 653, G40, hot-dip galvanized zinc coating; depth as needed to support impose loads, but 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 up to 10 Feet: 4 inches.

F. Furring Channels (Furring Members): Commercial-steel sheet having a coating with equivalent corrosion resistance complying with ASTM A 653, G40, hot-dip galvanized zinc coating.
   1. Steel Studs: ASTM C 645; minimum base metal thickness 0.0296 inch (22 gage).
   2. Depth: 3-5/8 inches unless otherwise indicated.

G. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
      b. Chicago Metallic Corporation; Drywall Furring 640 System.
      c. USG Interiors, Inc.; Drywall Suspension System.
   2. 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:
      a. Overhead Structural Support Spacing up to 4 Feet: 1-1/2 inches.
      b. Overhead Structural Support Spacing Between 4 Feet and 6 Feet: 2-1/2 inches.
      c. Overhead Structural Support Spacing Between 6 Feet and 10 Feet: 4 inches.

2.3 STEEL PARTITION AND SOFFIT FRAMING

A. Components, General: As follows:

1. Comply with ASTM C 645 for conditions indicated.
2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and having a coating with equivalent corrosion resistance complying with ASTM A 653, G40, hot-dip galvanized zinc coating. A40 galvannealed products are not acceptable.
    a. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to the authority having jurisdiction.

B. Steel Studs and Runners: ASTM C 645; depth 3-5/8 inches unless otherwise indicated; thickness as follows:
1. 0.027 inch (22 gage) unless otherwise indicated or required by referenced standards to support indicated loads within maximum deflections specified.
2. 0.0296 inch (22 gage) for the following applications:
    a. For studs supporting wall-mounted items.
    b. For studs in partitions that are not braced or secured at top.
    c. At fire door frames.
    d. Wherever abuse-resistant or impact-resistant wallboard is indicated.
    e. Where indicated.
3. Equivalent Gauge “EQ” steel studs and runners:
    a. Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems, ProSTUD/ProTRAK products, or a comparable product from one of the members of the SFIA.
    b. Minimum base-steel thickness: 0.0190 inch (20 EQ) 65ksi.
    c. “EQ” (Equivalent Gauge Thickness) steel studs and runners: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (Approved May 2012) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation report is acceptable to show conformance to this requirement.

C. Proprietary Deflection Track: Steel sheet top runner manufactured to prevent cracking of gypsum board applied to interior partitions resulting from deflection of structure above; in thickness indicated for studs and in width to accommodate depth of studs.
1. Product: Subject to compliance with requirements, provide one of the following:
    a. ClarkDietrich Building Systems; MaxTrak slotted deflection track.
    b. The Steel Network; VertiClip SLD.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated or needed for supported items; minimum base metal thickness 0.0312 inch.

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: 0.0179 inch.
2. Depth: 7/8 inch unless otherwise indicated.

F. Resiliant Furring Channels: ½ inch deep, steel sheet members designed to reduce sound transmission.
1. Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Resilient Channel RC Deluxe (RCSD), or approved equal.

G. Headers and Jambs: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, or web depths indicated, unpunched, with stiffened flanges and as follows:
   1. Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems: Heavy Duty Studs – HDS**,** or approved equal.

H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1 ¼ inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
   1. Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Z-Furring Channel, or a comparable product.

I. Backing Plate: Proprietary fire-resistance-treated blocking and bracing in width indicated.
   1. Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Danback Fire-Treated Wood Backing Plate D24F, or approved equal.

J. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard (GWB): ASTM C 1396.
   1. Type: Type X.
   2. Thickness: 5/8 inch.
   3. Long Edges: Tapered.
   4. Location: Typical locations, unless otherwise indicated.

C. Abuse-Resistant Gypsum Wallboard (ARW): ASTM C 1629/C 1629M, [Level 3].
   1. Core: 5/8 inch, Type X.
   2. Long Edges: Tapered.
   3. Locations: Finish floor up to door frame height in all locations.

D. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
   1. Product: USG Corporation; Firecode C Core.
   2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
   3. Long Edges: Tapered.

2.5 TILE BACKING PANELS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178.
   1. Product: Dens-Shield Tile Backer; G-P Gypsum Corp.
   2. Core: 5/8 inch, Type X.

C. Cementitious Backer Units: ANSI A118.9.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Custom Building Products; Wonderboard.
      b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
      c. United States Gypsum Co.; DUROCK Cement Board.
   2. Thickness: 5/8 inch.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc, except as otherwise indicated.
   2. Shapes:
      a. Cornerbead: Use at outside corners, unless otherwise indicated.
      b. Expansion (Control) Joint: Use where indicated.

B. Self-Masking Trim: PVC edge moldings with removable protective strip.
   1. Use at exposed panel edges where gypsum board abuts other materials.
   2. Manufacturers: Subject to compliance with requirements, provide products one of the following:
      a. Fast Mask S-100; Flannery Inc.
      b. Peel Away Angle; A-Z Bogart Inc.
      c. Ceiling Trim No. 22 Vinyl Tech; Plastic Components Inc.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. MM Systems Corporation.
      d. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
   4. Column Collars: Provide assemblies including aluminum molding, PVC spacer and adjustable band to form reveal between gypsum board surfaces and round steel columns, with flange to receive joint compound.
      a. Basis-of-Design Product: Fry Reglet Corp.; Column Collar.
      b. Finish: Manufacturer's standard chemical conversion coating for field painted finish.
      c. Spacer Color: White. / Dark bronze.

D. Special Corner Finishing Units: Paper-surfaced, pre-formed units with tapered, high-strength plastic membrane forming rigid corner unit with inner surface and paper flap that bond permanently with gypsum board with joint compound.
   1. Product: ULTRACORNER; No-Coat.
   2. Locations: At Contractor's option, special corner finishing units may be used at exterior corners in gypsum board walls instead of metal corner beads.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape: Paper, unless otherwise indicated.
   1. Joint Tape for Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels: As recommended by manufacturer.

E. Joint Treatment for GRG Fabrications: Provide materials complying with ASTM C 475 and with the recommendations of the manufacturers of both glass-fiber reinforced gypsum fabrications and joint treatment materials for each application indicated.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Isolation Strip at Exterior Walls: Asphalt-saturated organic felt; ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

E. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
      b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

F. Acoustical Sealant for Concealed Joints: 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. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
      b. Pecora Corp.; AIS-919.
      c. Tremco, Inc.; Tremco Acoustical Sealant.

G. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

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. 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.

3.3 INSTALLING STEEL FRAMING, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
   1. Isolate ceiling assemblies where they abut or are penetrated by building structure.

2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
   a. Use proprietary deflection track except as otherwise indicated.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Suspend ceiling hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers 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.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
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. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

E. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.

3. Furring Channels (Furring Members): 16 inches o.c.

F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
1. Where studs are installed directly against exterior walls, install asphalt-felt isolation strip between studs and wall.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
1. Cut studs 1/2 inch short of full height to provide perimeter relief.
2. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

D. Install steel studs and furring at 16 inches o.c., unless otherwise indicated.

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. 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.
1. Install two studs at each jamb, unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

G. 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.

3.6 APPLYING AND FINISHING PANELS, GENERAL

A. 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 the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports. 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 steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Form control and expansion joints with space between edges of adjoining gypsum panels.

I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect open concrete coffers or 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-wide joints to install sealant.

J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations, and trim edges with L-bead edge trim where edges of gypsum panels are exposed.

K. Sound-Insulated Assemblies: Seal construction at perimeters, behind control and expansion 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 C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
   1. Penetrations in assemblies include, but are not limited to, ducts, pipes, conduits, electrical boxes, outlets and switches.

L. 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 o.c. for vertical applications.
   2. Space fasteners in tile substrates a maximum of 8 inches o.c.

3.7 PANEL APPLICATION METHODS

A. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to the 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 board.
      b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
      c. In locations where gypsum board surfaces will be illuminated by continuous cove lighting, install panels vertically.

B. Multilayer Application 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 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

C. Multilayer Application 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.

D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

E. Multilayer Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.
   1. Where required for fire-resistance ratings, fasten base layers and face layers separately to supports with screws.

F. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

G. Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile and behind shower enclosures. Install with 1/4-inch gap where panels abut other construction or penetrations.
   2. Cementitious Backer Units: ANSI A108.11.
      a. Locations: Install at curved wall surfaces indicated to receive tile, in nominal 12-inch wide segments.

3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.8 INSTALLING 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 at locations indicated on Drawings and according to ASTM C 840, in specific locations approved by Architect for visual effect.

C. Special Corner Finishing Units: Apply according to manufacturer's instructions at outside wall corners.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

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 those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
   1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated.
   3. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
   4. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where indicated.
      a. Provide Level 5 finish in locations where gypsum board surfaces will be illuminated by continuous cove lighting and at locations indicated on Drawings.

END OF SECTION 09 2116

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Floor tile.
2. Wall tile.
3. Tile accessories and trim.
4. Waterproof membrane for thin-set tile installations on elevated floor slabs.
5. Crack-suppression membrane.
6. Provisions for installing crack-suppression membrane at all minor cracks in floor slabs receiving floor tile. Allow for 15% of total floor tile area for crack suppression membrane.

B. Related Sections include the following:
1. Division 03 Section "Cast-In-Place Concrete": Monolithic slab finishes specified for tile substrates.
2. Division 04 Section "Unit Masonry": Parging applied to masonry walls to receive tile.
3. Division 07 Section "Joint Sealants": Sealing of expansion, contraction, control, and isolation joints in tile surfaces.
4. Division 09 Section "Gypsum Board Assemblies": Tile backer board.

1.2 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.3 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with minimum value of 0.6 as determined by testing identical products per ASTM C 1028.

B. Load-Bearing Performance: For ceramic tile installed on walkway surfaces, provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project:
1. Extra Heavy: Passes cycles 1 through 14.

1.4 SUBMITTALS

A. Product Data: For each type of tile, mortar, grout, patching material, and other products specified.

B. Shop Drawings: For the following:
   1. Tile patterns and locations.
   2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces including details of typical expansion, control joint [and crack suppression membrane] installation.
   3. Flooring transition details between tile and other floor materials.
   4. Build-up of sloped substrate for shower areas and adjacent areas to receive thinset tile, including indication of methods to achieve slopes to drain.

C. Grout Samples for Initial Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

D. Samples for Verification: Include Sample sets showing the full range of variations expected.
   1. Tile: 12 inches square for each type and color, mounted on cement backer units, with grouted joints.
   2. Accessories: Full-size units of each type of trim and accessory for each color required.
   3. Stone Thresholds: 6-inch lengths.

E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

F. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.

G. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

H. 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 of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance. Installer to have a minimum 5 years experienced and or member of the NTCA (National Tile Contractors Association).

B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:
   1. Stone thresholds.
   2. Waterproofing/Crack Suppression Membranes.
   3. Joint sealants.

E. Mockups: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
   1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Include mockup of sloped tile floors in bathrooms and of typical expansion, and control joints and crack suppression joints.
   3. Notify Architect 7 days in advance of the 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 proceeding with final unit of Work.
   6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   7. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.6 PRODUCT HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.
   1. Comply with underlayment and patching material manufacturer's written recommendations for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting product performance.

B. Close areas to traffic during patching and underlayment application and for time period after application recommended in writing by manufacturer.

1.8 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

B. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated; but not less than 2 unopened boxes for each color, pattern and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Tile Products: Subject to compliance with requirements, provide products indicated in Finish Legend on the Drawings.
   1. For comparable products proposed by Contractor, submit detailed product data for scheduled products and proposed products for comparison and Architects approval.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Tile Setting and Grouting Materials:
      a. Mapei Corporation.
      b. Custom Building Products.
      c. Laticrete International, Inc.
      d. Boiardi Products Corporation.
      e. Bonsal: W.R. Bonsal Company.
      f. Bostik.
      g. C-Cure Corporation.
      h. Southern Grouts & Mortars, Inc.
      i. TEC Incorporated.
      j. ProSpec, LLC.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
   2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with latest 2014/2015 ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
   1. Match colors, textures, and patterns indicated by referencing manufacturer's standard designations for these characteristics.
   2. Provide tile trim and accessories that match color and finish of adjoining flat tile.
   3. Tile for Sloped Surfaces: For tile located on ramps and other sloped surfaces, provide textured surface pattern for slip resistance, selected by Architect from full range of available patterns.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

A. Ceramic Wall Tile: Flat tile as follows:
   1. Module Size: As indicated on Drawings
   2. Thickness: 5/16 inch.
   3. Face: Plain with cushion edges.
   4. Finish: As indicated on Drawings.
   5. Product: As indicated on Drawings.

B. Porcelain Paver Tile: Flat tile as follows:
   1. Composition: Porcelain.
   2. Module Size: As indicated on Drawings
   3. Thickness: 1/2 inch.
   4. For polymer-modified grouted paver tile, precoat with temporary protective coating.
   5. Product: As indicated on Drawings.

C. Trim Units: Provide metal trim units as indicated in finish notes to finish paver tile tops, outside corners and cove base.
   1. Shapes: As follows, selected from manufacturer’s standard shapes:
      a. Base: As indicated on Design Selection Summary
      b. Wainscot Cap: Schluter Jolly, color coated aluminum
      c. External Corners: Schluter Quadec, colored coated aluminum
      d. Internal Corners: Schluter DILEX-AHK, color coated aluminum.

2.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANES

A. General: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.

B. Chlorinated-Polyethylene-Sheet Product: Nonplasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric, for adhering to latex-portland cement mortar; 60 inches wide by 0.030-inch nominal thickness.

1. Product: The Noble Company; Nobleseal TS.

C. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber and fabric reinforcement.
   1. Products: One of the following:
      a. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
      b. MAPEI Corporation; “Mapelastic 400”.
      c. Custom Building Products: “Custom 9240” Waterproofing and Anti-fracture Membrane.

2.5 SETTING AND GROUTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A and as specified below:
   1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
   2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
   3. Latex Additive: Manufacturer's standard acrylic resin or styrene-butadiene-rubber 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 (Thinset - Small Format Tile 12 inches or less in any direction): ANSI A118.4, composed as follows:
   1. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.
      a. For wall applications, provide nonsagging, latex-portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.

C. Latex-Portland Cement Mortar (Medium Bed/LHT Thin Set-Large Format Tile Mortar 12 inches or greater in any direction): ANSI A118.4 and ANSI A118.15.

D. High Performance Cement Grout: ANSI A118.7.
   1. Polymer Type: Ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients. Basis of Design: Custom Building Products; Prism Ultimate Performance Grout
      a. Unsanded grout mixture for joints 1/8 inch and narrower.
         1) Laticrete; Permacolor
         2) Mapei; Ultracolor
      b. Sanded grout mixture for joints 1/8 inch and wider.
         1) Laticrete; Permacolor
         2) Mapei; Ultracolor

E. Water-Cleanable Epoxy Grout: ANSI A118.3.
   1. Chemical resistant water cleanable epoxy grouts. Basis of Design: Custom Building Products Ceg-Lite 100% Epoxy Grout or equal product by one of the following:

a. Laticrete; Spectra Lock Pro
b. Mapei; Kerapoxy

2.6 MISCELLANEOUS MATERIALS

A. Cementitious Patching and Underlayment: Cement-based, polymer-modified product that can be applied in uniform thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations. For patching, use trowel-grade product suitable for build-up of slopes as indicated. For underlayment, use self-leveling product.
   1. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
   2. Compressive Strength: Not less than 4700 psi at 28 days when tested according to ASTM C 109/C 109M.
   3. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.
   4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch, or coarse sand as recommended by underlayment manufacturer.
      a. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
   5. Water: Potable and at a temperature of not more than 70 deg F.
   6. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

C. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.
   1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a 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.

E. Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
   1. Applications: Apply grout sealer to grout joints in tile floors, except in locations with epoxy grout; and to grout joints in tile walls located in toilet rooms.
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Aqua Mix; Grout and Tile Sealer
      b. Custom Building Products; Tilelab grout and Tile Sealer
      c. Bonsal, W. R., Company; Grout Sealer.

d. Bostik; CeramaSeal Grout Sealer.
e. C-Cure; Penetrating Sealer 978.
f. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
g. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

2.7 MIXING

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
1. Add materials, water, and additives in accurate proportions.
2. 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.

B. Mixing Cementitious Patching and Underlayment Materials: Provide batch type mechanical mixer for mixing topping material at Project site. Equip batch mixer with a suitable charging hopper, water storage tank, and a water measuring device. Use only mixers that are capable of mixing aggregates, cement, and water into a uniform mix within specified time, and of discharging mix without segregation.
1. Proportion materials following manufacturer's recommendations.
2. Provide aggregate as recommended by manufacturer for thickness of pour required.

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 from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
2. 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 before installing tile.
3. Verify that cracks and each type of joint in tile substrates are coordinated with tile joint locations; if not coordinated, adjust in consultation with Architect.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with thinset mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.
   1. Use trowel-able leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
   2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Prepare and clean substrate for application of cementitious patching and underlayment according to manufacturer's written instructions for substrate indicated. Provide clean, dry, neutral-pH substrate for product application.
   1. Treat nonmoving substrate cracks to prevent cracks from telegraphing (reflecting) through underlayment according to manufacturer's written recommendations.
   2. Fill substrate voids to prevent underlayment from leaking.
   3. Concrete Substrates: Mechanically remove laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond according to manufacturer's written instructions.
   4. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.
   5. Joints: Mark locations of joints in base slab so that joints in top course will be placed directly over them.

D. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in 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.

E. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:
   1. Grout release.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCNA Installation Guidelines: TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation." Refer to latest edition. Comply with TCNA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work

neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. 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.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Movement Joints: Locate expansion, control, contraction, isolation, and other joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces as referenced in EJ171 from latest edition of TCNA and at other locations where fillers are placed between adjoining construction elements.
   2. Prepare joints and apply sealants to comply with requirements of Division 07 Section "Joint Sealants."

H. Grout tile to comply with ANSI A108.10.

3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

C. Do not install tile over membrane until membrane has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Ceramic Tile Installation Schedule, including those referencing TCNA installation methods and ANSI A108 series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:
   1. Paver Tile: 1/4 inch, unless otherwise indicated or directed.

3.6 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Installation Schedule, including those referencing TCNA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:
   1. Wall Tile: 1/16 inch.

3.7 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 high performance cement grout residue from tile as soon as possible.
   2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Grout Sealer: Apply grout sealer to tile joints~~,~~ according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

C. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.
   1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
   2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

E. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.8 PREPARATION FOR COMMERCIAL TRAFFIC

A. Clean quarry tile flooring not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean tile flooring using method recommended by manufacturer.
   1. Apply first coat of maintenance finish on floor tile after cleaning.
   2. Coordinate selection of floor finish product with Owner's maintenance service.

3.9 CERAMIC TILE INSTALLATION SCHEDULE

A. Porcelain Paver Tile Bonded to Concrete Floors (Bathrooms):
   1. Installation Method: Thin-set mortar bonded to concrete subfloor; TCNA F113.
   2. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
      a. Medium-bed for large format tile (LFT), latex portland cement mortar.
      b. High performance cement sanded grout.

B. Interior Wall Tile Thinset on Tile Backer Board:
   1. Setting Method: Glass-mat, water-resistant backer board; thin-set mortar; TCNA W245 and ANSI A108.5.
   2. Thin-Set Mortar: Latex-portland cement mortar.
   3. Grout: High performance cement unsanded grout.

END OF SECTION 09 3000

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 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.
   2. Acoustical sealant for acoustical panel ceilings.
   3. Acoustical panel replacement for repairing ceilings damaged by other contractors.

B. Related Sections include the following:
   1. Division 9 Section “Gypsum Board Assemblies”.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordinate 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: Set of full-size Samples of each type, color, pattern, and texture.
   2. Wood Panels: Set of 12-inch square Samples with specified wood species, pattern and finish.
   3. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch-long Samples of each type, finish, and color.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

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. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
1. Locate mockups in the location and of size directed by Architect.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 PRODUCT 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.

1.5 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.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Acoustical Ceiling Panels and Scrubbable mineral fiber panels : Full-size panels equal to 2 percent of quantity installed; but not less than 3 boxes of each type.
2. Suspension System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceiling or comparable product by one of the following:
   1. CertainTeed Corp.
   2. USG
   3. Rockfon

2.2 ACOUSTICAL PANELS

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. Standard Mineral Fiber Acoustical Panels: Match appearance characteristics indicated for each product type listed in finish legend (ACT)
   1. Color: White.
   2. Edge Detail: Square Lay-In.
   3. Thickness: 3/4 inch, unless otherwise indicated.
   4. Style: As indicated on drawings.
   5. Size: As indicated on Drawings.
   6. Sag Resistance: Equivalent to Armstrong "HumiGuard Plus No Sag Warranty"; 90 percent humidity.

C. SoundScapes Blades:
   1. Surface texture: Fine
   2. Composition: Fiberglass
   3. Color: Custom Color as selected by Architect
   4. Size & Design: Custom as noted by Architect
   5. Edge Profile: Square
   6. Recycled content: 43%
   7. Acoustics: Sound absorption up to 1.80 Noise Reduction Coefficient (NRC) ASTM C423 dependent on blade depth and spacing.
   8. Flame Spread: ASTM E 1264; Class A (UL)
   9. Dimensional Stability: HumiGuard Plus; Anti-Microbial, inherent

2.3 METAL SUSPENSION SYSTEMS

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.

E. 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.
   1. Structural Classification: Intermediate-duty system.
   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. Cap Finish: Painted flat black / gun metal grey at locations with wood panels.

F. 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. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

G. 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. Expansion Joints: Special moldings and trim to accommodate building expansion joints in ceiling assemblies as indicated.
4. 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 306 & 315 and bathrooms.

H. 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.

I. Aircraft Cable:
1. Item 6655L8CR - 4-Point Hanging Kit (4 per bag)
2. Item 625530 - Extended Hanging Aircraft Cables (30' length, 4 per bag). For use with Item 6655L8CR when longer cables are needed

2.4 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.

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 5100

SECTION 09 64 66 - WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Maple, strip flooring on floating, double-layer, plywood subfloor.
   2. Maple strip flooring, nosings and trim at front of stage platform, matching appearance of wood athletic flooring.
   3. Field finishing wood athletic flooring.
   4. Game line markings and custom painted graphics.

B. Related Sections include the following:
   1. Division 01 Section "Temporary Facilities and Controls": Self-adhesive surface protection products to protect flooring installations during construction.
   2.
   3. Division 09 Section "Resilient Athletic Flooring."
   4. Division 09 Section "Stage Wood Flooring":
   5. Division 11 Section "Gym Equipment": Floor inserts for standards and other athletic equipment.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details including location and layout of each type of wood, athletic-flooring assembly and accessory. Include the following:
   1. Expansion provisions and trim details.
   2. Layout, colors, widths, and dimensions of game lines and markers.
   3. Locations of athletic equipment floor anchors installed in wood flooring.

C. Samples for Initial Selection: Manufacturer's color charts showing colors and glosses available for the following:
   1. Floor finish.
   2. Game-line and marker paint.

D. Samples for Verification: For each type of wood flooring, game-line and marker paint, finish, and accessory required; approximately 12 inches long and of same thickness and material indicated for the Work. Include sample sets showing the full range of normal color and texture variations expected.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed wood, athletic flooring similar in material, design, and extent to that indicated for this Project and whose work has

resulted in wood, athletic-flooring installations with a record of successful in-service performance.

1. Installer's Responsibilities: Installation of flooring assembly, including the following:
   a. Subfloor.
   b. Wood finish flooring.
   c. Game lines and markers.
   d. Finish.
   e. Accessories.

B. Painter Qualifications: Engage an experienced painter to apply custom graphics painted on athletic flooring. Comply with details indicated, or if not indicated, according to sketches prepared by Architect.

C. Maple Flooring: Comply with MFMA grading rules for grade and cut.
   1. Certification: Provide flooring that carries MFMA Certification Mark on each piece.

1.4 PRODUCT HANDLING

A. Deliver wood-flooring materials in unopened cartons or bundles.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.

C. Store wood-flooring materials in a dry, warm, well-ventilated, weathertight location.

D. Move wood flooring into spaces where it will be installed at least 7 days before installation.

1.5 PROJECT CONDITIONS

A. Conditioning: Maintain relative humidity conditions planned for building occupants, but not greater or less than the relative humidity range recommended by MFMA, and an ambient temperature between 55 and 75 deg F in spaces to receive wood flooring for at least seven days before installation, during installation, and for at least seven days after installation. After postinstallation period, maintain relative humidity conditions and ambient temperature planned for building occupants.
   1. Open sealed packages to allow wood flooring to acclimatize.
   2. Do not install flooring until it adjusts to the relative humidity of and is at the same temperature as the space where it is to be installed.
   3. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by flooring and finish manufacturer, but not less than 10 days.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Flooring System: . Robbins Sports Systems; Bio-Channel SB Floor System or approved equal.

B. Finishing Materials: Subject to compliance with requirements, provide products by one of the following:
   1. Basic Coatings.
   2. BonaKemi USA, Inc.
   3. Crawford Laboratories.
   4. Hillyard Inc.
   5. Flooring-assembly manufacturer.

2.2 MAPLE FLOORING

A. Flooring shall be Eco-Friendly 25/32” (20mm) thick x 2 1/2" (63mm) facewidth; 2-1/4” (57mm) facewidth available at mill discretion; 2nd & Better grade; Factory Sanded Advantage™ XL (Non-Factory Sanded maple available as contractor option); T&G and EM, KD Northern Hard Maple; Continuous Strip XLplus™ Flooring as manufactured by Robbins and graded in accordance with MFMA-FJ rules. Flooring will have XLplus™ technology to reduce or eliminate routine spacing for expansion.
   1. Grade: 2nd and Better

2.3 SUBFLOOR SYSTEM

A. 16 gauge coated metal anchor channels.

2.4 FASTENERS

A. Flooring – 1 ¾” (45mm) barbed cleats or staples.

B. Channel anchors – 2” (51 mm) ong steel SPIKE anchor

2.5 FINISHING MATERIALS

A. Floor-Finish System: MFMA-listed system of compatible components recommended by flooring and finish manufacturers for application indicated.
   1. Type: Group 5, Water Based Finishes; polyurethane.
   2. Floor Sealer: Pliable, oil-based, penetrating type.
   3. Finish Coats: Formulated for gloss finish and multicoat application.

B. Game-Line and Marker Paint: High-gloss enamel compatible with finish and recommended by finish and paint manufacturers for this purpose.

2.6 ACCESSORY MATERIALS

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils thick.

B. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.

C. Wall Base: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches; with premolded outside corners.

1. Color: Selected by Architect from manufacturer's full range.
2. Provide wall base for perimeter of wood athletic flooring area indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of wood-flooring assembly. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with wood athletic flooring. Verify that concrete slabs comply with the following:
   1. Finishes of subfloors comply with tolerances and other requirements specified in Division 03 Section "Cast-In-Place Concrete" for slabs receiving stage wood flooring
      a. Grind high spots and fill low spots to provide a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
   2. Repair damaged and deteriorated concrete according to Maple Flooring Manufacturers Association’s written recommendations.
   3. Verify that concrete substrates are dry according to test methods recommended in writing by wood athletic flooring manufacturer and as follows:
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application 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) of slab in 24 hours.
      b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
      c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
   4. Verify that concrete substrates have neutral Ph in compliance with wood athletic flooring manufacturer’s written requirements. Perform tests recommended by manufacturer to confirm alkalinity. Proceed with application only after substrates pass testing.
   5. Testing Failure: Remedy new floor slabs exceeding the wood athletic flooring manufacturer’s limits for alkalinity and/or moisture content using methods acceptable to wood athletic flooring manufacturer, in a manner and with materials compatible with wood athletic flooring assembly. Required remediation must be performed by the contractor at no cost to the Owner and with no extension of the contract time.

3.2 INSTALLATION

A. General: Comply with flooring-assembly manufacturer's written instructions, but not less than recommendations of MFMA applicable to flooring type indicated.

B. Pattern: Lay flooring parallel with the long dimension of the space to be floored, unless otherwise indicated.

C. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
   1. Cover expansion spaces with base molding, trim, and saddles, as indicated.

D. Vapor Retarder: Install with joints lapped a minimum of 6 inches and sealed.

E. Installation Tolerances: 1/8 inch in 10 feet variance from level.

3.3 SANDING AND FINISHING

A. Allow installed flooring to acclimate to ambient conditions for at least 10 days before sanding.

B. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.

C. Finish: Apply seal and finish coats of finish system according to manufacturer's written instructions. Provide not less than four coats total and not less than two finish coats.
   1. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.
   2. Lines and Markers: Apply game-line and marker paint and custom graphics between final seal coat and first finish coat according to paint manufacturer's written instructions. Mask flooring to provide sharp edges. Where game lines cross, break minor game line at intersection; do not overlap lines.

D. Install base molding and other cover trim indicated for expansion spaces at edges and interruptions of flooring.

3.4 CLEANING AND PROTECTION

A. Protect wood flooring during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.

B. Clean wood athletic flooring not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each Project area. Use cleaning materials and procedures recommended in writing by wood athletic flooring manufacturer.

END OF SECTION 09 64 66

SECTION 09 65 00 – RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Vinyl composite tile (VCT).
   2. Solid vinyl tile (SVT)
   3. Quartz tile (QT)
   4. Resilient wall base. (RWB)
   5. Resilient stair treads and landing tiles. (RT)
   6. Resilient flooring accessories.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry": Prefaced masonry wall base units installed at locations of resilient sheet flooring; and requirements to rake mortar joints at base of wall units to allow resilient sheet to be tucked in below masonry base.
   2. Division 07 Section "Joint Sealants": Sealant for joints between glazed masonry wall base and resilient flooring.
   3. Division 09 Section "Carpeting": Installation of resilient carpet accessories, and for carpeted areas to receive resilient wall base.

1.2 SUBMITTALS

A. Product Data: For each type of product specified.

B. Shop Drawings: Show installation details including the following:
   1. Tile patterns and locations.
   2. Profiles, locations and colors of resilient accessories and flooring transition strips; and floor leveling for transitions between flooring materials.

C. Samples for Initial Selection: Manufacturer's color charts showing colors and patterns available for flooring.
   1. Include selection samples showing colors and glosses available for game-line and marker paint.

D. Samples for Verification: For each different color and pattern of resilient flooring and accessory specified, showing full range of variations expected in these characteristics:
   1. Tiles: Full size units.
   2. Sheet Flooring: 6 x 9-inch sections.
   3. Resilient Wall Base and Accessories: 12 inches long.

E. Maintenance Data: To include in Operating and Maintenance Manual specified in Division 01.

1.3 QUALITY ASSURANCE

A. Accessibility: Comply with applicable requirements of the Americans with Disabilities Act "Accessibility Guidelines" (ADAAG), together with ANSI A117.1 "Accessible and Usable Buildings and Facilities."

B. Single-Source Responsibility for Flooring: Obtain each type, color, and pattern of flooring from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

C. Fire Performance Characteristics: Provide resilient flooring with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Critical Radiant Flux: 0.45 watts per sq cm or more per ASTM E 648.
   2. Smoke Density: Less than 450 per ASTM E 662.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to resilient floorings including, but not limited to, the following:
   1. Inspect and discuss condition of substrate and other preparatory work performed by other trades and including testing requirements specified in Part 3.
   2. Review condition of concrete substrates in detail for cleanliness of concrete substrate and methods of contamination and dirt removal.
   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. Review special designs and patterns.
   5. Review protection procedures.

1.4 PRODUCT HANDLING

A. Deliver resilient flooring materials and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F and 90 deg F.

C. Store tiles on flat surfaces.

D. Move resilient flooring and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.5 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70 deg F in spaces to receive flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F.

B. Do not install flooring materials until they are at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during flooring installation.

D. Moisture Testing Results: Should testing indicate moisture and/or pH levels in concrete slabs exceed the limits acceptable to manufacturer of the floor finish, the contractor shall take necessary means to correct the deficiency. Proposed corrective action other than the method specified herein shall be submitted to the Architect for approval.

1.6 SEQUENCING AND SCHEDULING

A. Install flooring and accessories after other finishing operations, including painting, have been completed.

B. Do not install flooring over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by flooring manufacturer's recommended bond and moisture test.

1.7 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
   1. Tile: Furnish not less than one box for each 50 boxes or fraction thereof, of each class, wearing surface, color, pattern and size of resilient floor tile installed.
   2. Sheet Flooring: Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof, in roll form of each different composition, wearing surface, color, and pattern of sheet floor covering installed.
   3. Wall Base and Accessories: Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof of each different type and color of resilient wall base and accessory strips installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Resilient Flooring Products: Subject to compliance with requirements, provide products indicated in Finish Legend on the Drawings.
   1. For substitutions proposed by Contractor, submit detailed product data for scheduled products and proposed substitutions for comparison.

2.2 COLORS AND PATTERNS

A. Resilient Flooring Product Colors and Patterns: As indicated on Drawings, or if not indicated, as selected by Architect from manufacturer's full range.

2.3 RESILIENT TILE

A. Vinyl Composite Tile (VCT): Armstrong Flooring
1. Thickness: .125 inch.
2. Size: 12 by 12 inches.
3. Product: As indicated on Drawings.

B. Solid Vinyl Tile (SVT): Shaw Contract
1. Class: Class 1, monolithic, Type A (smooth)
2. Thickness: 0.125 inches (3.17 mm).
3. Size: 36 by 36 inches.
4. Product: As indicated on Drawings.

2.4 RESILIENT WALL BASE

A. Rubber Wall Base: ASTM F 1861.
1. Type (Material Requirement): TS (rubber, vulcanized thermoset).
2. Group (Manufacturing Method): I (solid).
3. Style: Cove with top-set toe.
4. Minimum Nominal Thickness: 1/8 inch.
5. Height: 4 inches.
6. Lengths: Cut to size from coils; use of 4 foot or other single lengths is not permitted.
7. Exterior Corners: Job-formed.
8. Interior Corners: Job-formed.

2.5 RESILIENT STAIR ACCESSORIES

A. Rubber Stair Treads: Products of style suitable for use indicated and complying with FS RR-T-650, Composition A, Type 2 design (designed) products complying with the following requirements.
1. Type: Combination tread and riser.
2. Type 2 Design: Raised-disc pattern with minimum 2 inch wide contrasting nosing strip in color selected by Architect.
3. Thickness: 1/4 inch tapering to 3/16 inch at back edge.
4. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, obtain Architect’s approval for joint locations.

B. Rubber Tiles for Stair Landings: Homogeneous rubber tile, solid color.
1. Wearing Surface: Molded pattern matching stair treads.
2. Thickness: 0.125 inch.
3. Size: Not less than 18 by 18 inches.

2.6 RESILIENT FLOORING ACCESSORIES

A. Resilient Molding Accessory:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.

b. Flexco, Inc.
c. Johnsonite.
d. R.C.A. Rubber Company (The).
e. Roppe Corporation, USA.
f. VPI, LLC; Floor Products Division.

2. Description: Carpet edge for glue-down applications, Low profile reducer strip for resilient floor covering, Joiner for tile and carpet, Transition strips.
3. Material: Rubber.
4. Profile and Dimensions: As indicated or as selected by Architect from all types available.
5. Colors and Patterns: As indicated on drawings or as selected by Architect from full range of industry colors.

2.7 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

C. Adhesives (Cements): Water-resistant type recommended by flooring manufacturer to suit resilient flooring products and substrate conditions indicated.

D. Seam Sealer: Formulation provided or approved by floor covering manufacturer for products indicated.

E. Rod for Heat-Welding Seams: Product of floor covering manufacturer in color selected by Architect.

F. Transition Strips: Rubber accessory moldings for edges of flooring and transitions between different flooring materials, as specified in Division 09 Section "Resilient Base and Accessories."

G. Stair Tread Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates not conforming to tread contours.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine areas where installation of resilient flooring will occur, with Installer present, to verify that substrates and conditions are satisfactory for installation and comply with flooring manufacturer's requirements and those specified in this Section.

B. Concrete Substrates: 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 whose presence would interfere with bonding of adhesive.

Determine adhesion and alkalinity characteristics by performing tests recommended by resilient material manufacturer.

2. Finishes of subfloors comply with tolerances and other requirements specified in Division 03 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
    a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 90% relative humidity level measurement.
5. Testing Failure: New floor slabs exceeding the finish manufacturer’s limits for alkalinity and/or moisture shall be remedied by the contractor at no cost to the Owner and with no extension to the contract. The following remediation is acceptable to the Architect. Other methods must be submitted to the Architect for approval.
    a. Basis of Design Product: For treatment applied on new cured floor slabs, provide “CS2000 2-Day System” as manufactured by Creteseal, Santa Ana, CA (800 278 4273), www.creteseal.com. This system requires preparation of new slabs including shot-blasting of surface, patching cracks, application of moisture treatment and skim coating with approved underlayment.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive flooring.

B. Use trowelable leveling and patching compounds per flooring manufacturer's directions to fill cracks, holes, and depressions in substrates.

C. Slope substrate with patching material to produce flush transitions between flooring materials. Taper transitions not less than 24 inches in any direction, unless otherwise approved by Architect.
    1. In locations where flooring materials change at a doorway, extend elevated portion of patched area so taper is located beyond door opening, and so finish flooring is level at adjacent doors.

D. Use stair tread nose filler per tread manufacturer's directions to fill nosing substrates not conforming to tread contours.

E. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by flooring manufacturer.
    1. Do not use solvents.
    2. Chemically strip existing flooring surfaces scheduled to receive resilient flooring, if recommended by manufacturer of new floor covering materials.

3. Lightly scarify all floors using rotary floor machine with Carborundum stones, spring steel scrapers or equivalent to remove surface contamination and adhered dirt.

F. Broom or vacuum clean substrates to be covered by resilient flooring immediately before installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

G. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.3 RESILIENT FLOORING INSTALLATION, GENERAL

A. General: Comply with flooring manufacturer's installation directions and other requirements indicated that are applicable to each type of flooring included in Project.

B. Where demountable partitions and other items are indicated for installing on top of finished floor, install flooring before these items are installed.

C. Scribe, cut, and fit flooring to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

D. Extend flooring into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

F. Install flooring on covers for telephone and electrical ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly adhere edges to perimeter of floor around covers and to covers.

G. Adhere flooring to substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed installation.

H. Use full spread of adhesive applied to substrate in compliance with flooring manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

I. Hand roll flooring where required by tile manufacturer.

J. Apply game-line and marker paint according to manufacturer's written instructions. Mask flooring to provide sharp edges.

K. Tuck resilient flooring into raked joint at base of prefaced masonry wall base units.
1. Apply joint sealant to fill joint after installation of resilient flooring.

3.4 INSTALLATION OF TILES

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 at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.

B. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain running in one direction as directed by Architect.

3.5 INSTALLATION OF RESILIENT ACCESSORIES

A. Apply resilient wall base to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
   1. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
   2. Install inside and exterior corners before installing straight pieces.
   3. Form inside corners on job from straight pieces of maximum lengths possible by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce snug fit to substrate.
   4. Form outside corners on job from straight pieces of maximum lengths possible by shaving back of base at point where bending will occur. Remove a strip perpendicular to length of base and only deep enough to produce a snug fit without bends whitening or removal of more than half the thickness of wall base.

B. Apply resilient accessories to stairs as indicated and according to manufacturer's installation instructions.

C. Place resilient flooring accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.

3.6 FIELD QUALITY CONTROL

A. Testing: Arrange for testing electrical resistance of static-control resilient floor covering systems for compliance with requirements in accordance with Owner's electrostatic-discharge control program.
   1. Arrange for testing of floors prior to performing any floor polish procedures.

3.7 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing flooring installation:
   1. Remove visible adhesive and other surface blemishes using cleaner recommended by flooring manufacturers.
   2. Sweep or vacuum floor thoroughly.

3. Do not wash floor until after time period recommended by resilient flooring manufacturer.
4. Damp-mop flooring to remove black marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by flooring manufacturer.
   1. If recommended by flooring manufacturer, apply protective floor polish to flooring surfaces that are free from soil, visible adhesive, and surface blemishes.
      a. Use commercially available product acceptable to flooring manufacturer.
      b. Coordinate selection of floor polish with Owner's maintenance service.
   2. Cover flooring with undyed, untreated building paper or self-adhesive surface protection until inspection for Substantial Completion.
   3. Do not move heavy and sharp objects directly over resilient flooring. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09 65 00

SECTION 09 66 23 – EPOXY TERRAZZO FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Epoxy terrazzo with divider and accessory strips.
2. Precast terrazzo stair assemblies.

B. Related Requirements:

1. Concrete subfloor, Section 03 Cast-in-place Concrete
2. Attach metal stairs including any welding and/or reinforcing, Section 05 Metal Pan Stairs

1.02 DEFINITIONS

A. NTMA: National Terrazzo and Mosaic Association, Inc.

1.03 PREINSTALLATION MEETINGS

A. Pre installation Conference: The General Contractor shall conduct a conference at project site before Terrazzo Contractor begins installation.

1. The General Contractor shall invite Terrazzo Contractor, the Architect and representatives of the Owner.
2. Review methods and procedures related to terrazzo including, but not limited to, the following:

a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

b. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

c. Review terrazzo mixes, designs and patterns.

d. Coordination with the work of other installers.

1.04 SUBMITTALS

A. Product Data: Terrazzo Contractor shall submit Product Data for each type of product required for installation including:

B. Shop Drawings: Terrazzo Contractor shall prepare and submit Shop Drawings that include plans, elevations, sections, component details and attachments to other work. Include terrazzo installation requirements. Show layout of the following:

1. Divider strips.
2. Expansion joint strips.
3. Accessory strips.
4. Terrazzo patterns.
5. Abrasive strips.
6. Stair treads.

C. Samples:

1. Terrazzo Contractor shall prepare and submit a maximum of three samples, sizes 6 by 6 inches for each color and type of terrazzo specified.

2. Terrazzo Contractor shall submit a maximum of three samples, 6 inches in length for each color and type of precast terrazzo specified.

3. Accessories: 6 inch long Samples of each type and kind of exposed strip item required

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: Terrazzo Contractor shall submit two copies of qualification data.

1. Include list of projects indicating name and location of project, name of Owner, name and contact information for General Contractor, and name and contact information for Architect.

2. The Terrazzo Contractor shall furnish a written statement from the manufacturer that the installer is acceptable.

B. Material Certificates:

1. Epoxy Resin: For each type of resin required indicating that materials meet specification requirements, signed by manufacturer.

2. Aggregate: For each type of aggregate required indicating compatibility with terrazzo mix, signed by aggregate supplier.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Literature: Terrazzo Contractor shall submit two copies of maintenance recommendations from NTMA and/or manufacturer's maintenance recommendations.

1.07 QUALITY ASSURANCE

A. Acceptable Epoxy Resin Manufacturer: An Associate Member of the NTMA, experienced in manufacturing epoxy resin in accordance with NTMA standards and with a record of successful in-service performance, as well as sufficient production capacity to produce required materials.

B. Acceptable Terrazzo Contractor: A Contractor Member of NTMA or NTMA contractor prospective member whose work has resulted in construction with a record of successful in-service performance.

1. Installer shall have completed terrazzo installations within the past 5 years of scale and complexity similar to the proposed installation.

2. Installer must be approved by the manufacturer of the floor surfacing materials.

C. Terrazzo Standards: Terrazzo Contractor shall furnish materials and install terrazzo according to NTMA's “Terrazzo Specifications and Design Guide” and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

D. Source Limitations for Aggregates: Terrazzo Contractor shall obtain each color, grade, type and variety of granular materials from sources with resources to provide materials of consistent quality in appearance and physical properties.

E. Mockups: Terrazzo Contractor shall construct a mockup to demonstrate aesthetic effects and set quality standards for materials and execution. Mock-up size must not be less than 4 square feet for a portable mock-up.
1. Build mockup as indicated on Drawings. Acceptable mock-up to be standard of quality for installed work.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion

1.08 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered to Project site in supplier's original wrappings and containers, labeled with source or manufacturer's name, material or product brand name, date of manufacture, and lot/batch numbers if any.

B. Materials shall be stored in their original, undamaged packages and containers, in a location where they will not be exposed to direct sunlight.

1. Epoxy components shall be stored in a space where the ambient temperature can be maintained 60 and 80 deg. F before use.

C. Follow all manufacturer's specific instructions and prudent safety practices for storage and handling.

1.09 PROJECT CONDITIONS

A. General Contractor shall provide sufficient water, temporary heat and light, and adequate electric power with suitable outlets connected and distributed for use within 100 feet of any working space.

B. General Contractor shall provide temporary enclosures and other suitable methods to protect adjacent spaces from damage during installation.

1. Maintain ambient temperatures in the area to receive terrazzo at not less than 60 deg. F.
2. Maintain adequate ventilation in the area to receive terrazzo.

C. Terrazzo Contractor shall protect other adjacent work from water and dust generated by grinding operations.

1.10 GUARANTEE

A. One year from date of substantial completion of terrazzo installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE

A. As a basis of design, specifications based on Key Resin Company, Key Epoxy Terrazzo.

1. Local Representation: Jon Lattin, 610-559-8182

B. Provide conforming products based on:

1. Key Resin Company: Key Epoxy Terrazzo

2. Key Resin is considered the approved quality standard for this job. Any other material bid for this section must have as a minimum the standards set forth in this specification.

C. Other acceptable manufacturer’s upon a compliance review include:

1. Dex-O-Tex Terrazzo

2. Terroxy Resin Systems

2.02 MATERIALS

A. Moisture Primer: Moisture Vapor Primer required for base bid.

1. MVT Primer: Key #597 MVT Primer

2. If MVT levels are greater than base bid MVT primer limits, additional MVT control will be an Add-On to the contract.

B. Primer: As recommended, manufactured and supplied by epoxy resin manufacturer.

1. Primer: Key #502 Primer

C. Crack Suppression/Isolation Membrane: As recommended, produced and supplied by approved terrazzo resin formulator, having minimum 120 percent elongation potential per ASTM D 412. Allow 15% crack coverage for slab-on-grade, 100% coverage for elevated slab.

1. Key #580 Flexible Epoxy

2. Reinforcement: Fiberglass scrim.

D. Epoxy Resin Matrix: Key #108 Epoxy resin, a two-component, 100% solids resin complying with specified performance requirements.

1. Color: As required for mix indicated.

E. Aggregates: As required to match architect's terrazzo sample

1. Comply with NTMA gradation standards.

2. Abrasion and Impact Resistance: Loss of 40 percent or less when tested according to ASTM C 131 (LA Abrasion).

3. Aggregates shall contain no deleterious or foreign matter.

F. Divider Strips:

1. Material: Aluminum

2. Strip Thickness: 1/8".

3. Type: "L" strip: 3/8 inch by 1/2 inch.

2.03 PRECAST TERRAZZO

A. Provide conforming products based on:

1. Wausau Tile Precast Terrazzo

2. Romoco Precast Terrazzo

3. Angelozzi Precast Terrazzo Products

B. Precast Terrazzo Base: Minimum 3/8-inch-thick, epoxy terrazzo units cast in maximum lengths possible, but not less than 36 inches. Comply with precast manufacturer's written recommendations for fabricating precast terrazzo base units in sizes and profiles indicated.

1. Type: Straight Base

2. Top Edge: Eased edge with polished top surface.

3. Outside Corner Units: With finished returned edges or mitered at outside corner.

4. Color, Pattern, and Finish: Match adjacent poured-in-place terrazzo flooring field.

C. Precast Terrazzo Stair Units: 3/4" to 1” epoxy terrazzo (or 2-1/2-inch-thick, cement terrazzo) stair units cast in maximum lengths possible. Comply with precast manufacturer's written recommendations for fabricating precast terrazzo units in sizes and profiles indicated. Finish exposed-to-view edges and reveals to match face finish. Ease exposed edges to 1/8-inch radius.

1. Provide the following types of precast stair units:

a. Stair treads.

2. Color, Pattern, and Finish: Match adjacent poured-in-place terrazzo flooring as indicated.

D. Setting Materials for Precast Terrazzo: One of the following acceptable to the manufacturer of precast terrazzo units.

1. Epoxy Adhesive: Two component, compatible with terrazzo units and substrate.

2.04 MISCELLANEOUS ACCESSORIES

A. Sealer: Terrazzo Contractor shall provide a non-ambering, clear sealer that is chemically neutral; does not impair terrazzo aesthetics or physical properties; is recommended by terrazzo matrix manufacturer. Sealers shall comply with the following:

1. Comply with requirements of authorities having jurisdiction.

2. Surface Friction: Not less than 0.6 (ADA) according to ASTM D 2047.

3. Water Based Sealer Properties: With pH factor between 7 and 10.

B. Moisture Mitigation Primer: Two-component, high solids, moisture tolerant, high density, low odor, epoxy-based product produced by epoxy terrazzo resin

manufacturer specifically recommended to reduce alkalinity levels and moisture emission to not more than 3 lbs/ per 1000 sq. ft per 24 hours.

1. Key Epocon SL Moisture Vapor Control System.

2. Key Resin #635-PLUS Moisture Vapor Transmission Primer.

2.05 MIXES

A. Terrazzo Selection: Terrazzo Contractor shall provide standard terrazzo mix(es) according to the following:

1. Key Resin Sample CTS-25002 (White)

2. Key Resin Sample CTS-25003 (Grey)

B. Proportions for Epoxy Terrazzo Topping: Comply with resin supplier's recommendations.

C. Mixing of Terrazzo Topping: Mix epoxy components with aggregates in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The General Contractor and Architect shall examine substrates and areas, with Terrazzo Contractor present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

1. Slab Flatness Tolerance: Subfloor is not to vary more than 1/4 inch from true plane in a 10 foot span.

2. Cracks: Locate cracks and joints in concrete substrates. Verify location of control joints and expansion joints in epoxy terrazzo flooring.

B. The General Contractor shall be responsible for correcting non-conforming concrete substrates using materials compatible with epoxy terrazzo flooring system and as approved by the Terrazzo Contractor.

1. Materials used to correct nonconforming conditions must be compatible with the selected epoxy system and be approved by the manufacturer of epoxy resin materials and Terrazzo Contractor.

C. Terrazzo Contractor shall proceed with installation only after unsatisfactory conditions, including levelness tolerances, cracking, excessive moisture vapor transmission, and alkalinity have been corrected.

3.02 PREPARATION

A. General Contractor shall broom clean area to receive terrazzo to remove loose chips and all foreign matter.

B. Terrazzo Contractor shall mechanically abrade concrete surface to provide a standard profile of ICRI (International Concrete Repair Institute) CSP 3-5.

1. Repair any deteriorated or damaged concrete with a standard epoxy sand fill mixture per manufacturer's instructions.

C. The General Contractor shall retain the services of an independent testing laboratory to verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to epoxy resin manufacturer's written instructions.

1. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 90 percent relative humidity level measurement when using the moisture vapor tolerant primer as specified in 2.02.A.

D. Terrazzo Contractor shall provide flexible epoxy crack isolation/suppression membrane as defined in Section 2.02.B.

3.03 POURED-IN-PLACE TERRAZZO INSTALLATION

A. General: Apply each component of the Epoxy Thin-set Terrazzo Flooring System in compliance with manufacturer's written installation instructions and strictly adhere to mixing and installation methods, recoat windows, cure times and environmental restrictions.

B. Strip Materials: Terrazzo Contractor shall install strip materials as follows:

1. Divider and Control-Joint Strips:

a. Locate divider strips in locations indicated.

b. Install control joint strips back to back in locations indicated.

c. Install strips in epoxy adhesive without voids below strips.

2. Accessory Strips: Install as required to provide a complete installation.

C. Placing Terrazzo:

1. Prime subfloor in accordance with manufacturer's recommendations.

2. Install Key #580 Flexible Epoxy Membrane as outlined above.

3. Reinforce membrane with fiberglass scrim where recommended by the manufacturer.

4. Proportion and thoroughly blend the materials.

5. Place mixture to achieve specified thickness.

D. Finishing: Terrazzo Contractor shall finish the terrazzo topping as follows:

1. Rough Grinding:

a. Grind with 24 or finer grit stones or with comparable diamond abrasives.

b. Follow initial grind with 60/80 grit stones or with comparable diamond abrasives.

2. Grouting:

a. Clean terrazzo with clean water and rinse. Allow to dry.

b. Apply epoxy grout per manufacturer's instructions.

c. Allow grout to cure.

3. Fine Grinding/Polishing: Grind with a minimum 200 grit or with comparable diamond abrasives until all grout is removed from surface.

E. Terrazzo Cleaning: Terrazzo Contractor shall clean finished terrazzo as follows:

1. Remove grinding residue from terrazzo surface.

2. Wash terrazzo surfaces immediately after final grinding of terrazzo flooring with water and allow surfaces to dry thoroughly.

F. Sealing: Terrazzo Contractor shall seal terrazzo according to sealer manufacturer’s written instructions.

3.04 PRECAST TERRAZZO INSTALLATION

A. Terrazzo Contractor shall install precast terrazzo units as follows:

1. Precast Terrazzo Stair Units: Use epoxy adhesive to install treads over steel or concrete substrates according to ANSI 108.6.

3.05 REPAIR

A. Terrazzo Contractor shall repair terrazzo areas that evidence lack of bond between topping and underbed according to NTMA’s written recommendations.

3.06 PROTECTION

A. After application of the sealer, the Work shall be ready for final inspection and acceptance by the Owner or his agent.

B. The General Contractor shall protect the finished floor after the Terrazzo Contractor has completed final grinding and applied sealer to terrazzo surfaces.

END OF SECTION 09 66 23

SECTION 09 67 23 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Solid color, smooth finish, self-leveling slurry, 1/8” thick flooring with integral cove base

B. Related Sections include the following:
   1. Division 01 Section "Temporary Facilities and Controls": Self-adhesive surface protection products to protect flooring installations during construction.
   2. Division 03 Section "Cast-in-Place Concrete": Concrete substrates to receive resinous flooring.
   3. Division 07 Section "Joint Sealants": Joint-sealant materials and installation of sealant materials at joints in resinous flooring systems.

1.2 SUBMITTALS

A. Product Data: Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors, textures, and patterns available.

C. Samples for Verification: 6 inches square, applied by Installer for this Project to a rigid backing, in color, texture, and finish indicated.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Material Test Reports: From a qualified independent testing agency indicating and interpreting test results of the resinous flooring's reaction to chemicals and other reagents and substantiating compliance with requirements.

F. Maintenance Data: For resinous flooring to include in the maintenance manuals specified in Division 01.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who has specialized in installing resinous flooring similar in material, design, and extent to that indicated for this Project and who is acceptable to resinous flooring manufacturer.
   1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to install resinous flooring systems specified.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, and sealing or finish coats, through one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

C. Field Samples: On floor area selected by Architect, provide full-thickness resinous flooring system samples that are at least 48 inches square to demonstrate texture, color, thickness, chemical resistance, cleanability, and other features of each resinous flooring system required. Simulate finished lighting conditions for review of in-place field samples.
   1. If field samples are unacceptable, make adjustments to comply with requirements and apply additional samples until field samples are approved.
   2. After field samples are approved, these surfaces will be used to evaluate resinous flooring.
   3. Obtain Architect's approval of field samples before applying resinous flooring.
   4. Final approval of colors will be from field samples, not samples submitted for verification.

1.4 PRODUCT HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.
   1. Maintain a minimum slab temperature of 60 degrees before, during, and for 72 hours after installation and at a minimum 5 degrees above dew point during installation..

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

D. Moisture Testing Results: Should testing indicate moisture and/or pH levels in concrete slabs exceed the limits acceptable to manufacturer of the floor finish, the contractor shall take necessary means to correct the deficiency. Corrective action shall not require extension of the contract or additional cost to the Owner. Proposed corrective action other than the method specified herein shall be submitted to the Architect for approval.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: FlowResin Flowfresh SL (self-leveling slurry with BCM broadcast quartz), urethane topcoat seamless flooring system.
   1. System Materials:
      a. Topping: FlowResin Flowfresh SL with Polygiene anti-microbial additive included.
      b. The aggregate shall be Estes BCM quartz aggregate
      c. Topcoat: FlowResin Flowfresh SR Sealer with Polygiene anti-microbial additive included.
   2. Patch Materials
      a. Shallow Fill and Patching: Use FlowResin Flowfresh SR (up to ¼ inch).
      b. Deep Fill and Sloping Material (over ¼ inch): Use FlowResin Flowfresh HF
      c. Substitutions: For substitutions proposed by Contractor, submit detailed product data for basis-of-design products and proposed products for comparison, in accordance with substitution procedures specified in Division 01

2.2 MATERIALS

A. Resinous Flooring: Resinous floor surfacing system consisting of primer; body coat(s) including resin, hardener, aggregates, and colorants; and sealing or finish coat(s).
   1. Topping: Flowfresh SL
   2. Percent Solids 100 %
   3. VOC <10 g/L
   4. Bond Strength to Concrete ASTM D 4541 > 400 psi, failure in substrate
   5. Compressive Strength, ASTM C 579 8,128 psi
   6. Tensile Strength, ASTM C 307 1,450 psi
   7. Flexural Strength, ASTM C 580 2,900 psi
   8. Impact Resistance @ 125 mils, MIL D-3134, 160 inch lbs

B. Topcoat: Flowfresh SR Sealer
   1. Percent Solids 100%
   2. VOC <10 g/L
   3. Elongation at break, ASTM D638 20%
   4. Tensile Strength, ASTM C307 1,650 psi
   5. Flexural Strength, ASTM C580 2,400 psi

C. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrate according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminates incompatible with resinous flooring.
   1. Comply with ASTM C 811 requirements and ICRI Guidelines #310-2-1997, unless resinous flooring manufacturer's written instructions are more stringent.
   2. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
      a. Provide surface profile of concrete substrate equivalent to concrete surface profile CSP 3-5.
   3. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates comply with resinous flooring manufacturer’s written requirements, in no instance to exceed a maximum 75% relative humidity level measurement.
   5. Testing Failure: Remedy new floor slabs exceeding the resinous flooring manufacturer’s limits for alkalinity and/or moisture content using methods acceptable to resinous flooring manufacturer, in a manner and with materials compatible with resinous flooring assembly. Required remediation must be performed by the contractor at no cost to the Owner and with no extension of the contract time.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

F. All isolation/expansion and other joints subject to movement: Movement joints must be honored through the flooring system. Comply with manufacturer’s recommendations for movement joints.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
      a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply first slurry body coat by spreading with rubber squeegee and cross rolling at spread rate of 140-145 sq. feet per gallon.
   1. Allow material to self-level for 10-15 minutes.
   2. Broadcast aggregates and, after resin is cured, remove excess aggregates.
   3. Smooth imperfections such as high spots before application of second broadcast.

D. Apply second slurry body coat by pulling out with V-notched rubber squeegee and cross rolling at spread rate of 65-70 sq. feet per gallon.
   1. Allow material to self-level for 10-15 minutes.
   2. Broadcast aggregates to produce required surface texture.

E. Integral Cove Base: Apply cove base mix to wall surfaces at locations indicated. Round internal and external corners. Install cove base according to manufacturer's written instructions and details including taping, mixing, priming, troweling, sanding, and topcoating of cove base.

F. Apply grout coat and seal coat, of type recommended by resinous flooring manufacturer to produce finish indicated. Apply in number of coats and at spreading rates recommended in writing by manufacturer.

3.3 CLEANING AND PROTECTING

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

B. Clean resinous flooring not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each Project area. Use cleaning materials and procedures recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 6813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes carpet tile and installation.

B. Related Sections include the following:
1. Division 03 Section "Cast-in-Place Concrete": Curing compounds and other concrete treatments compatibility with carpet and carpet cushion adhesives.
2. Division 09 Section "Resilient Flooring": Wall base and termination strips installed with carpet.
3. Division 09 Section "Sheet Carpeting": Broadloom carpet applications.

1.2 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.

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. 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-long Samples.

D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

E. 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.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.3 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. Mockups: Before installing carpet tile, install mockups for each type of carpet tile installation required to demonstrate aesthetic effects and qualities of materials and execution. Install mockups to comply with the following requirements, using materials indicated for the completed Work:
   1. Install mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect 7 days in advance of dates and times when mockups will be installed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before starting work.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   6. Approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.

1.4 PRODUCT HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling" for delivery, storage and handling of carpet tile.

1.5 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.

1.6 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: 15 years from date of Substantial Completion.

1.7 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 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Carpet Products: Subject to compliance with requirements, provide products indicated in Finish Legend on the Drawings.
   1. Drawing Type Designation: [CPT-#].
   2. For substitutions proposed by Contractor, submit detailed product data for scheduled products and proposed substitutions for comparison.

B. Performance Characteristics: As follows:
   1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
   2. Dry Breaking Strength: Not less than 100 lbf per ASTM D 2646.
   3. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC-165.
   4. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) per AATCC-16.
   5. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC-174.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and that is recommended by carpet tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Verify that substrates and conditions are satisfactory for carpet tile installation and comply with requirements specified.

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 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)."

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

F. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 15, "Protection of Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 72 00 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Vinyl wall covering.
   2. Digital Vinyl Wall Coverings (WC-01)
   3. Tackable wall surfacing material.
   4. Tackable wall surfacing material applied over continuous cork sheet material, for direct application to wall surface.

B. Related Sections include the following:
   1. Division 09 Section "Painting and Coating": Priming wall surfaces.

1.2 SUBMITTALS

A. Product Data: Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.

B. Shop Drawings: Show location and extent of each wall covering type. Indicate seams and termination points.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available.

D. Samples for Verification: Sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
   1. Wall Covering Material: Full-width sample, not less than 36 inches long, from dye lot used for the Work.
      a. Submit sample with specified treatments applied.
      b. Mark top and face of material.
      c. Show complete pattern repeat.

E. Maintenance Data: To include in the operation and maintenance manual specified in Division 01.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed 5 projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fire-Test-Response Characteristics: Provide wall coverings 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.
   1. Flame Spread: 25 or less.

2. Smoke Developed: 450 or less.

C. Mockups: Prior to installing wall covering, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before start of final unit of Work.
5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.4 PROJECT CONDITIONS

A. Space Enclosure and Environmental Limitations: Do not install wall covering until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

B. Lighting: Do not install wall covering until a lighting level of not less than 15 foot-candles is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering manufacturer for full drying or curing.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
1. Rolls of Wall Covering Material: Full-size units equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 DIGITAL WALL COVERINGS (WC-01)

A. Basis-of-Design Products: Subject to compliance with requirements, provide basis-of-design products indicated in Finish Legend on Drawings.
1. For substitutions proposed by Contractor, submit detailed product data for basis-of-design products and proposed substitutions for comparison, in accordance with substitution procedures specified in Division 01.

B. Wall Covering Materials: All materials shall be mercury and cadmium free. Material shall have antimicrobial inhibitors throughout the vinyl substrate and shall conform to CFFA-W-101-D, CCC-408-D, C, B, A by using the test methods as outlined by FedSpec CCC-T-191B, except as otherwise specified.
   1. Total Weight: 13 oz per sq. yard/20 oz per lineal yard
   2. Vinyl weight: 17 oz.
   3. Fabric weight: 3 oz.
   4. Fabric backing cotton, cotton/polyester blend, polyester nonwoven.
   5. Breaking strength: Exceed type II minimum breaking strength 50 lbs. machine direction-warp. Exceeding Type II minimum 55 obs. Cross machine direction fill.
   6. Fire testing: ASTM-E84 Tunnel Test; Class A
      a. NFPA 286 Corner Burn Test; Class A
      b. NFPA 265 Corner Burn Test; Class A
      c. BS476 Part 6 & 7.
   7. Mold/Mildew/Bacterial Resistance:
      a. ASTM-G21 Specifications: Pass all requirements of CCCw-408-D

C. Custom Digital Graphic: Digital image shall be printed on 54-inch vinyl wall covering substrate using UV piezo drop on demand technology or Ecosol with environmentally friendly ink systems. Printing produced in CMYK or RGB. Images shall be dried and fully cured prior to shipping.
   1. Digital image file for custom, multi-color graphic to be provided by Owner. Manufacturer to digitally manipulate image as required to produce digital wall coverings.

2.2 TACKABLE WALL SURFACE ASSEMBLIES

A. Natural Cork Sheet: Seamless, single layer, compressed fine-grain cork sheet, bulletin board quality; face sanded for natural finish.
   1. Thickness: 1/4 inch.

B. Tackable Facing Material: Fabric from same dye lot; color and pattern as follows:
   1. Product: As indicated on Drawings.
   2. Colors: As indicated on Drawings, or if not indicated, as selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Adhesives: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application, as recommended by wall covering manufacturer.

B. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall covering manufacturer.

C. Wall Liner for Masonry Walls: For application of vinyl wall coverings over masonry walls, provide rolled plaster wall covering substrate complying with the following:
   1. Basis-of-Design Product: Faster Plaster Heavy Duty Wall Liner No. 609; Flexi-Wall Systems, Div. of Wall & Floor Treatments Inc., Liberty SC, (1-800-843-5394).

2. Adhesive Product: Flexi-Wall No. 500 Adhesive.
3. Thickness: 50 mils.
4. Weight: 42 oz./sq. yd.
5. Roll Width: 48 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for moisture content and other conditions affecting performance of Work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt.

C. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.
1. Painted Surfaces: Treat areas susceptible to pigment bleeding.
2. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
3. Prime new gypsum board with primer recommended by wall covering manufacturer.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

E. Install wall liner, with no gaps or overlaps, where required by wall covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall covering installation until wall liner has dried.
1. For application of vinyl wall coverings over masonry walls, apply rolled plaster wall covering according to manufacturer's instructions and the following:
    a. Do not align seams with vertical mortar joints in masonry substrate.
    b. After installation of rolled plaster wall covering, treat mortar joints that have telegraphed through by wiping with joint compound using a broad knife on top of the wall liner.
    c. Allow to dry thoroughly, not less than 24 hours.
    d. Prime with latex primer and allow to dry before application of vinyl wall covering.

F. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION, GENERAL

A. General: Comply with wall coverings manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Cut wall covering panels in roll number sequence. Change run numbers at partition breaks and corners only.

C. Install wall covering with no gaps or overlaps.

D. For patterns that require matching, match pattern 72 inches above finish floor.

E. Install seams vertical and plumb at least 6 inches from outside corners and 3 inches from inside corners. No horizontal seams.

F. Remove air bubbles, wrinkles, blisters, and other defects.

G. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams.

H. Install tackable wall surface material over wall surfaces with continuous trowel-applied adhesive, with seams horizontal and level, with lowest seam 24 inches above finished floor.
   1. Double cut seams, with no gaps or overlaps. Remove air bubbles, wrinkles, blisters, and other defects.
   2. Sand joints between cork sheets before applying tackable facing material.
   3. After installation, remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

3.4 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended by wall covering manufacturer.

C. Replace strips that cannot be cleaned.

END OF SECTION 09 72 00

SECTION 09 84 13 - FIXED SOUND-ABSORPTIVE PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Back-mounted acoustical wall panels with fabric facing.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for acoustical wall panels, including plans, elevations, sections, details, and attachments to other Work.
   1. Show orientation of fabric application, pattern matching, and seams.

C. Samples for Verification: 8-by-11-inch units of each type of acoustical wall panel indicated; in sets for each color, texture, and pattern specified for facing materials, showing the full range of variations expected in these characteristics. Include samples of installation devices and accessories.

D. Product Certificates: Signed by manufacturers of acoustical wall panels 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.

F. Maintenance Data: For acoustical wall panels and facings to include in maintenance manuals specified in Division 01.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing acoustical wall panels similar to those indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Acoustical Wall Panels: Obtain acoustical wall panels from one source with resources to provide products of consistent quality in appearance and physical properties.

C. Fire-Test-Response Characteristics: Provide acoustical wall panels 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. Identify acoustical wall panels with appropriate markings of applicable testing and inspecting agency.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

1.4 PRODUCT HANDLING

A. Protect acoustical wall panels from excessive moisture when shipping, storing, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet-work, such as concrete and plaster, has been completed and cured to a condition of equilibrium. Protect panel edges from crushing and impact.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical wall panels until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify wall surface dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.6 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 Warranty: Written warranty, signed by manufacturer agreeing to repair or replace components of acoustical wall panel system that fail in performance, materials, or workmanship within specified warranty period. Failure in performance includes, but is not limited to, acoustical performance. Failure in materials includes, but is not limited to, sagging or distortion of facing or warping of core.
   1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTICAL WALL PANELS

A. Fabricate panels to sizes and configurations indicated; attach facing materials to cores to produce installed panels with visible surfaces fully covered and free from waves in fabric weave, wrinkles, sags, blisters, seams, adhesive, or other foreign matter.
   1. Fabricate panels in factory to exact sizes required to fit wall surfaces, based on field measurements of completed substrates indicated to receive acoustical wall panels.
   2. Where fabrics with directional or repeating patterns, or directional weave, are indicated, mark fabric top and attach fabric in same direction.

B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
   1. Thickness.

2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.

C. Sound-Absorption Performance: Provide acoustical wall panels with minimum noise reduction coefficients indicated, as determined by testing per ASTM C 423 for mounting type specified.

D. Back-Mounted, Edge-Reinforced Acoustical Wall Panels: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass- fiber board core; with edges and panel mounting points chemically hardened to reinforce panel perimeter against warpage and damage and for securing panel support clips; and complying with the following requirements:
   1. Basis-of-Design Product: Kinetics Noise Control; Hardside.
   2. Comparable Manufacturers: Subject to compliance with requirements, provide named product or comparable product by one of the following manufacturers:
      a. Armstrong World Industries.
      b. Decoustics Limited, A CertainTeed Ceilings Company.
      c. Golterman and Sabo.
      d. Panel Solutions Inc.
   3. Fabric Facing Material: As scheduled on Drawings.
      a. Pattern and Color: As selected by Architect from manufacturer's full range.
   4. Nominal Core Density: 5-7 lb/cu. ft.
   5. Nominal Overall Panel Thickness: 2 inches.
   6. Noise Reduction Coefficient: Not less than NRC 1.00.
   7. Panel Width: As indicated.
   8. Panel Height: As indicated.
   9. Edge Detail: Square.
   10. Corner Detail: Square.

E. Back-Mounting Accessories: Manufacturer's standard or recommended accessories for securely mounting panels, of type and size indicated, to substrates provided; and complying with the following requirements:
   1. Mechanically Mounted Edge-Reinforced Panels: Metal panel-clip and base-support bracket system consisting of two-part panel clips, with one part of each clip mechanically attached to back of panel and the other part to wall substrate, designed to support panels laterally; and base-support brackets designed to support full weight of panels; with both designed to allow for panel removal.

F. Panel Mounting Adhesive: As recommended by panel manufacturer for type of substrate and conditions of installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and blocking, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting acoustical wall

panel performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, and scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's written instructions for installation of panels using type of mounting accessories indicated or, if not indicated, as recommended by manufacturer.

B. Construction Tolerances: As follows:
   1. Variation from Plumb and Level: Plus or minus 1/16 inch.
   2. Variation of Joints from Hairline: Not more than 1/16 inch.

3.3 CLEANING AND PROTECTION

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

C. Remove surplus materials, rubbish, and debris resulting from acoustical wall panel installation, on completion of the Work, and leave areas of installation in a neat and clean condition.

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure acoustical wall panels are without damage or deterioration at time of Substantial Completion.

E. Replace panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 09 84 13

SECTION 09 91 33 - PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and field painting of the following:
   1. Exposed exterior items and surfaces.
   2. Exposed interior items and surfaces.
   3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:
      a. Architectural woodwork and casework, unless otherwise indicated.
      b. Acoustical wall panels.
      c. Toilet compartments.
      d. Metal lockers.
      e. Elevator entrance doors and frames.
      f. Elevator equipment.
      g. Finished mechanical and electrical equipment, unless otherwise indicated.
      h. Light fixtures.
      i. Distribution cabinets, except when in corridors or other normally occupied rooms.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Foundation spaces.
      b. Furred areas.
      c. Ceiling plenums.
      d. Utility tunnels.
      e. Pipe spaces.
      f. Duct shafts.
      g. Elevator shafts.
   3. Finished metal surfaces include the following:
      a. Anodized aluminum.
      b. Stainless steel, except exposed metal flashing indicated for field-painted finish.

c. Chromium plate.
d. Copper.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.
5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
1. Division 05 Section "Structural Steel": Shop priming structural steel.
2. Division 05 Section "Metal Fabrications": Shop priming ferrous metal; and factory finish for interior sheet metal closures.
3. Division 05 Section "Metal Railings": Shop priming metal railings.
4. Division 06 Section "Rough Carpentry": Exposed exterior wood framing for field-applied finish.
5. Division 06 Section "Architectural Woodwork": Woodwork for field-applied transparent finish.
6. Division 08 Section "Hollow Metal Doors and Frames": Shop priming steel doors and frames.
7. Division 09 Section "Gypsum Board Assemblies": Surface preparation for gypsum board.
8. Division 32 Section " Pavement Markings": Traffic-marking paint.

1.2 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat: Lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell: Low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
3. Satin: Low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semigloss: Medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full Gloss: High-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.3 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.
1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
   1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
   2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
   3. Submit Samples on the following substrates for Architect's review of color and texture only:
      a. Concrete Unit Masonry: 4-by-8-inch Samples of masonry, with mortar joint in the center, for each finish and color.
      b. Finished Wood: 12-inch-square Samples for each species on actual material.
      c. Metal: 4-inch-square Samples of flat metal and 8-inch-long Samples of solid metal for each color and finish.

C. 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.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type and color of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.
   1. Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
      a. Wall Surfaces: Provide samples on at least 100 sq. ft. of wall surface.
      b. Small Areas and Items: The Architect will designate an item or area as required.
   2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.
      a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.
   3. Final approval of colors will be from job-applied samples.

1.5 REGULATORY REQUIREMENTS

A. Comply with the applicable provisions of all codes, standards and specifications referenced in this section.

1. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the limits for VOC content of the Ozone Transport Commission (OTC) effective January 1st, 2005.

1.6 PRODUCT HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to area designated by Owner.
   1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 2 gal. of each material and color applied.
      a. Provide not less than 2 gal. for each part of multi-part formulations such as epoxy coatings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide the product listed in the Room Finish Schedule, one of the products in the paint schedules or a comparable product by one of the manufacturers listed below.

B. Manufacturers Names: One or more of the following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:
1. Benjamin Moore (BM).
2. Sherwin Williams (SW).
3. PPG Paints (PPG).
4. Samuel Cabot (Cabot).
5. Minwax Company (Minwax).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Provide systems indicated. Where substrates are required to be finished, but no system is specified for that particular substrate, employ finish system most closely related to that scope of work but modified with appropriate primers. In the case of components on walls, use system for adjacent wall or trim as determined by Architect. In the case of components on or suspended from ceilings or decks, use semigloss paint system.

C. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

D. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

E. Low-Emitting Materials: Interior paints and coatings 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."

F. Colors: Match colors indicated by reference to manufacturer's color designations.
   1. Provide contrasting colors for different elements exposed at ceiling level as selected by Architect, including steel trusses, roof deck, and ductwork.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
   1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. 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. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
   2. Mask surfaces and construction adjacent to paint application areas to prevent paint from spilling or spattering other areas.

B. Preparing Previously Painted Surfaces: Remove existing paint from surfaces indicated using scrapers or chemical paint stripper as follows:
   1. Strip loose, chipped, alligatored or otherwise deteriorated paint using methods that will not damage existing surfaces.
   2. Remove paint to sound substrate. Sound, well-adhered paint may remain on surface.
   3. Rub steel surfaces to remove rust bloom, and solvent clean prior to priming.
   4. Allow surfaces to dry and sand smooth.
   5. Clean surfaces so they are free of dust and dirt.
   6. Fill cracks, gouges and nail holes with suitable filler prior to application of first coat.
   7. Complete surface preparation to produce a smooth, uniform substrate suitable for application of primer and finish coats specified.

8. Apply test patch to confirm adhesion and compatibility. Check adhesion after 7 days.

C. Preparing Previously Painted Metal Lockers for Electrostatic Painting: Remove existing paint from ferrous metal surfaces as follows:
   1. Scrape to remove paint, exercising care not to damage metalwork.
   2. Clean surfaces with solvent following paint stripping.
   3. Before application of finish paint, clean surfaces so they are free of dust and dirt.
   4. Fill gouges, holes and other surface imperfections with epoxy filler. Spot prime filled areas and allow to dry before application of first finish coat.

D. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

E. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   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. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
      a. When transparent finish is required, backprime with spar varnish.
   4. 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.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
6. Stainless Steel: Mechanically abrade metal surface to create surface profile suitable for adhesion of paint, using No. 80 grit sandpaper and power sander.
    a. Wipe abrade surface with fast-drying thinner such as denatured alcohol or lacquer thinner.

F. 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.

G. 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. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. 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.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
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. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has

cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
    a. For electrostatic painting, use spray equipment designed to negatively charge the paint particles, with a connection of spray gun to a generator.
4. Use rollers, not spray equipment, for application on sound-absorbing concrete masonry units.

D. 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.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. 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.

G. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
2. Switchgear.
3. Panelboards.

H. 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.

I. 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.

J. 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.

K. 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.

L. 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.

M. 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. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
   1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

B. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

C. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
   1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.5 EXTERIOR PAINT SCHEDULE

A. General: Provide the finish systems scheduled for each material type indicated, applied at spreading rate recommended by manufacturer to achieve the total dry film thickness (DFT) listed.
   1. Provide 2 finish coats over the listed base coats (primer, filler, bond coat) except as otherwise indicated.

B. Exterior Ferrous Metal:
   1. High Perfomance Epoxy/Urethane System – Semi-gloss:
      a. Primer: Provide primer over bare metal and over shop-applied primers.
         1) SW: Recoatable Epoxy 646
         2) PPG: PITT-GUARD® Rapid-Coat DTR Epoxy Mastic Coating 95-245
         3) BM: Corotech Epoxy Mastic Coating (V160)
      b. First and Second Coats: Gloss urethane finish.
         1) SW: Hi-Solids Urethane coating, semi-gloss
         2) PPG Paints: PITTHANE® HB Semi-Gloss Urethane Enamel 95-8800 Series
         3) BM: Corotech Acrylic Aliphatic Urethane Gloss (V500)

C. Exterior Zinc-Coated Metal:
   1. Full-Gloss, Siliconized Alkyd-Enamel or Polyurethane Finish:
      a. Primer: Galvanized metal primer.
         1) SW: Pro-Cryl Universal Primer.
         2) PPG: Pitt-Tech® Plus Int/Ext DTM Industrial Primer 90-912 series
         3) BM: Super Spec Acrylic Metal Primer (P04)
      b. First and Second Coats: Full-gloss, exterior, siliconized alkyd enamel containing not less than 30 percent silicone or polyurethane finish.
         1) SW: Sher-Cryl HP Acrylic, semi-gloss.
         2) PPG: Pitt-Tech® Plus Int/Ext Semi-Gloss DTM Industrial Enamel 90-1210 series.
         3) BM: Ultras Spec HP DTM Acrylic Gloss Enamel (HP28)

3.6 INTERIOR PAINT SCHEDULE

A. General: Provide the finish systems scheduled for each material type indicated, applied at spreading rate recommended by manufacturer to achieve the total dry film thickness (DFT) listed.
   1. Provide 2 finish coats over the listed base coats (primer, filler, bond coat) except as otherwise indicated.

B. Interior Concrete Masonry Units (CMU):

1. Semigloss, Water Based Epoxy Finish: Provide the following unless otherwise indicated. / in, janitor closets, mechanical rooms, , locker rooms and receiving rooms.
    a. Block Filler: Two Coats acrylic latex high build block filler.
        1) SW: PrepRite Block Filler
        2) PPG: SPEEDHIDE Int / Ext Masonry Hi Fill Latex Block Filler 6-15
        3) PPG: PITT-GLAZE WB Int/Ext Block Filler Latex (for high moisture and intermittent moisture areas such as locker and shower rooms)
        4) BM: Coronado Super Kote 5000 Block Filler ((958-11)
    b. First and Second Coats: Semigloss acrylic epoxy finish.
        1) SW: ProIndustrial PreCatalyzed water based Epoxy, semi-gloss
        2) PPG: PITT-GLAZE WB SG Pre-Catalyzed Acrylic Epoxy 16-510
        3) BM: Corotech Pre Cat Waterbased Epoxy Semi Gloss ((V341)
2. Eggshell Finish: Provide the following in corridors and toilet room unless otherwise indicated
    a. Block Filler: Two Coats acrylic latex high build block filler.
        1) SW: PrepRite Block Filler
        2) PPG: SPEEDHIDE Int / Ext Masonry Hi Fill Latex Block Filler 6-15
        3) BM: Coronado Super Kote 5000 Block Filler (958-11)
    b. First and Second Finish Coats: Eggshell latex finish.
        1) SW: ProMar 200 Zero VOC Latex Eggshell
        2) PPG: SPEEDHIDE® Zero VOC Int Latex Eggshell 6-4310 series
        3) BM: Ultra Spec 500 Int. Eggshell (N538)

C. Gypsum Board Ceilings and Soffits:
1. Flat Acrylic Finish: Provide the following unless otherwise indicated.
    a. Primer: Latex-based, interior primer.
        1) SW: Promar 200 Primer.
        2) PPG: SPEEDHIDE® Zero VOC Int Latex Sealer 6-4900
        3) BM: Ultra Spec 500 Int. Latex Primer (N534)
    b. First and Second Coats: Flat, acrylic-latex-based, interior paint.
        1) SW: ProMar Ceiling paint
        2) PPG: SPEEDHIDE® Zero VOC Latex Flat 6-4110 series
        3) BM: Ultra Spec 500 Int. Latex Flat (N536)

D. Gypsum Board Walls:
1. Low-Luster, Acrylic-Enamel Finish: Provide the following unless otherwise indicated.
    a. Primer: Latex-based, interior primer.
        1) SW: Promar 200 Primer
        2) PPG: SPEEDHIDE® Zero VOC Int Latex Sealer 6-4900
        3) BM: Ultra Spec 500 Int. Latex Primer (N534)
    b. First and Second Coats: Low-luster, scrubbable acrylic-latex, interior enamel.
        1) SW: ProMar 200 Latex Eggshell
        2) PPG: SPEEDHIDE® Zero VOC Int Latex Eggshell 6-4310 series
        3) BM: Ultra Spec 500 Int. Latex Eggshell (N538)

E. Gypsum Board, Moisture Conditions:

1. Water-Reducible Epoxy Coating System: Provide the following for gypsum board surfaces located in toilet rooms, kitchen and food service storage rooms.
    a. Primer: Latex-based, interior primer.
        1) SW: ProMar 200 Primer
        2) PPG: SEAL GRIP Acrylic Universal Primer/Sealer 17-921 series
        3) BM: Ultra Spec 500 Int. Latex Primer (N534)
    b. First and Second Coats: Semi-gloss epoxy finish.
        1) SW: ProIndustrial Pre-Catalyzed Epoxy, semi-gloss.
        2) PPG: PITT-GLAZE WB SG Pre-Catalyzed Acrylic Epoxy 16-510
        3) BM: Corotech Pre Catalyzed Acrylic Epoxy Semi Gloss (V341)

F. Painted Interior Woodwork:
1. Semigloss, Acrylic Enamel Finish:
    a. Primer: Alkyd or latex-based, interior enamel undercoater.
        1) SW: Multi-Purpose Zero VOC Primer
        2) PPG: SPEEDHIDE® Zero VOC Int Latex Sealer 6-4900
        3) BM: Advance Waterborne Int. Alkyd Primer (790)
    b. First and Second Coats: Semigloss, Acrylic, interior enamel.
        1) SW: ProMar 200 Zero VOC, semi-gloss
        2) PPG: SPEEDHIDE Zero VOC Latex Semi-Gloss 6-4510 series
        3) BM: Ultra Spec 500 Int. Latex Gloss (N540)

G. Stained Interior Woodwork:
1. Polyurethane, Satin-Varnish Finish:
    a. Stain Coat:
        1) Minwax 250 interior wood stain.
        2) PPG: Olympic Interior Stains 41533 series
    b. Sealer Coat: Polyurethane reduced as recommended by manufacturer for use as sanding sealer.
    c. First and Second Finish Coats: Polyurethane varnish.
        1) SW: Wood Classics WB Polyurethane, satin.
        2) PPG: Olympic WB Polyurethane Clear Satin 42786

H. Ferrous Metal Components at Ceiling Level: Apply the following coating system to exposed roof trusses and other structural steel in exposed high areas.
1. Dry Fall, Alkyd Flat Finish: Where colors indicated exceed manufacturer's recommended pigment proportions, use semi-gloss paint system specified for interior ferrous metal.
    a. Primer: Metal primer.
        1) SW: Kem Bond HS
        2) PPG: Pitt-Tech Primer / Finish DTM Industrial Enamel 90-712
        3) BM: Super Spec HP Alkyd metal Primer (P06)
    b. First and Second Coats: Waterbased flat dry fall finish.
        1) SW: Waterbased Acrylic Dryfall Eggshell, B42W82
        2) PPG: SPEEDHIDE SUPER TECH WB 100% Acrylic Dry-Fog Semi-Gloss Latex 6-724XI
        3) BM: Super Kote 5000 Dry Fall Acrylic Flat (N110)

I. Interior Ferrous Metal: Apply the following coating system to interior ferrous metal not scheduled to receive another coating.

1. Semigloss, DTM Acrylic-Enamel Finish:
    a. Primer: Metal primer.
        1) SW: DTM Primer
        2) PPG: Pitt-Tech Primer / Finish DTM Industrial Enamel 90-712
        3) BM: Super Spec HP Acrylic Metal Primer (P04)
    b. First and Second Coats: Semigloss, alkyd, interior enamel.
        1) SW: DTM Acrylic Coating, semi-gloss
        2) PPG: Pitt-Tech® Plus Int/Ext Semi-Gloss DTM Industrial Enamel 90-1210 series.
        3) BM: Ultra Spec HP DTM Acrylic Semi Gloss (HP29)

J. Interior Zinc-Coated Metal: Apply the following coating system to interior ferrous metal not scheduled to receive another coating.
    1. Semigloss, Direct to Metal or Acrylic-Enamel Finish: Provide the following for items not within normal reach.
        a. Primer: Galvanized metal primer or vinyl wash.
            1) SW: DTM Primer
            2) PPG: Pitt-Tech Primer / Finish DTM Industrial Enamel 90-712
            3) BM: Super Spec HP Acrylic Metal Primer (P04)
        b. First and Second Coats: Semigloss, acrylic-latex, interior enamel.
            1) SW: DTM Acrylic Coating, semi-gloss
            2) PPG: Pitt-Tech® Plus Int/Ext Semi-Gloss DTM Industrial Enamel 90-1210 series.
            3) BM: Ultra Spec HP Acrylic DTM Semi Gloss (HP29)

END OF SECTION 09 91 33

SECTION 10 11 00 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following, including combination units:
   1. Porcelain enamel markerboards with aluminum frames.

B. Related Sections include the following:
   1. Division 06 Section "Architectural Woodwork": Custom fabricated tackboards.

1.2 SYSTEM DESCRIPTION

A. Markerboard Size Requirements: Provide markerboard assemblies using single panel of material without joints for sizes up to 5 feet in height. Joints are permitted in markerboards exceeding 5 feet in height, of type and spacing specified.

1.3 SUBMITTALS

A. Product Data: For each type of visual display board indicated.

B. Shop Drawings: For each type of visual display board required.
   1. Include dimensioned elevations. Show location of joints between individual panels where unit dimensions exceed maximum panel length.
   2. Include sections of typical trim members.
   3. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and textures available.

D. Samples for Verification: Of the following products, showing color and texture or finish selected. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected. Prepare Samples from the same material to be used for the Work.
   1. Visual Display Boards: Sample panels not less than 8-1/2 by 11 inches, mounted on the substrate indicated for the final Work. Include a panel for each type, color, and texture required.
   2. Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate. Include Sample sets showing the full range of color variations expected.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of markerboard manufacturer for both installation and maintenance of the type of sliding markerboard units required for this Project.

B. Mockups: Before installing visual display boards, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work.
   1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before proceeding with fabrication of visual display boards.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      a. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify field measurements before preparation of Shop Drawings and before fabrication to ensure proper fitting. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for framed visual display boards is based on factory assembled products of ASI Visual Display Products. Subject to compliance with requirements, provide the specified product or comparable products by one of the following:
   1. Claridge
   2. Moore Co.
   3. Egan Visual Inc.
   4. Aarco Products

2.2 MATERIALS, GENERAL

A. Particleboard: ANSI A208.1, Grade 1-M-1.

B. Fiberboard: ANSI A208.2, Grade MD.

C. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.3 VISUAL DISPLAY SURFACE ASSEMBLIES

A. Porcelain Enamel Markerboards: Balanced, high-pressure-laminated, porcelain enamel markerboards of 3-ply construction consisting of face sheet, core material, and backing.
   1. Face Sheet: 0.024-inch enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F.
      a. Markerboards: Provide manufacturer's standard, light-colored, special writing surface with gloss finish intended for use with erasable dry markers.
   2. Core: 3/8-inch-thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.
   3. Backing Sheet: 0.018-inch-thick, galvanized steel sheet backing.
   4. Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.

B. Tack Strips: Provide integral tack strip units of continuous lengths indicated, with metal frame and the following accessories:
   1. Display Rail: Provide continuous cork display rail approximately 2 inches wide, integral with tack strip.
   2. End Stops: Provide one end stop at each end of tack strip.

C. Display Rail: Provide individual display rail units of continuous lengths indicated, with metal frame and the following accessories:
   1. Provide continuous cork insert approximately 2 inches wide, integral with display rail.
   2. End Stops: Provide one end stop at each end of display rail.

2.4 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim for framed visual display boards of not less than 0.062-inch-thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure.
   1. Where size of visual display boards 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.
   2. Chalktray: Manufacturer's standard, continuous, box-type, aluminum chalktray with slanted front and cast-aluminum end closures for each chalkboard and markerboard.
   3. Map Rail: Furnish map rail at top of each unit, complete with the following accessories:
      a. Display Rail: Provide continuous cork display rail approximately 1 or 2 inches wide, as indicated, integral with map rail.
      b. End Stops: Provide one end stop at each end of map rail.
      c. Map Hooks: Provide 2 map hooks with flexible metal clips for every 48 inches of map rail or fraction thereof.

d. Flag Holder: Provide one flag holder for each room.

2.5 FABRICATION

A. Porcelain Enamel Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.
1. Cut joints straight and true. Space joints symmetrically. Fit and match panels before shipment to provide a continuous, uniform writing surface.
2. Length: Furnish panels approximately equal in length with permissible variation not more than 3 inches in either direction of equal spacing. Allow 1/4-inch clearance at trim in length and width for fitting. Provide lengths of panels in each space as follows:
a. Up to 5 feet, 1 panel.
b. More than 5 feet but less than 9 feet, 2 panels.
c. More than 9 feet but less than 13.5 feet, 3 panels.
d. More than 13.5 feet but less than 18 feet, 4 panels.
e. More than 18 feet but less than 22.5 feet, 5 panels.
f. More than 22.5 feet but less than 27 feet, 6 panels.

B. Assembly: Provide factory-assembled, markerboard and tackboard units, unless field-assembled units are required.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
2. Provide hairline vertical joint system between abutting sections of chalkboards and markerboards; do not use trim or mullions.

2.6 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall surfaces, with Installer present, for compliance with requirements and other conditions affecting installation of visual display boards.
1. Surfaces to receive markerboards shall be free of dirt, scaling paint, and projections or depressions that would affect smooth, finished surfaces of markerboards.

2. Surfaces to receive tackboards shall be dry and free of substances that would impair the bond between tackboards and substrate.
3. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.

B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.
1. Seal wall surfaces indicated to receive tackable wall surface material.

3.3 INSTALLATION

A. Deliver factory-built visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Install units in locations and at mounting heights indicated and according to manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

C. Coordinate Project-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.4 ADJUSTING AND CLEANING

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units according to manufacturer's written instructions.

END OF SECTION 10 11 00

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Panel signs for room identification.
   2. Flag signs for room identification.
   3. Panel signs for Code-required stairway signs.
   4. Dimensional characters of cast aluminum for interior building signs.
   5. Cast-metal plaques.

B. Related Sections include the following:
   1. Division 23 Sections: Labels, tags, and nameplates for mechanical equipment.
   2. Division 26 Sections: Labels, tags, and nameplates for electrical equipment and for illuminated exit signs.
   3. Division 32 Section "Asphalt Paving": Parking signs.

1.2 REFERENCES

A. ASTM D 790-03 -- Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

B. ASTM D 1003-00 -- Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
   1. Provide message list for each sign, including large-scale details of wording and lettering layout.
   2. Provide sign schedule with interior elevations indicating mounting location for each sign mounted on permanent construction. Show proposed mounting method and height. Include interior elevations showing each sign location relative to adjacent door, frame or other construction.
   3. Wiring Diagrams: For internally illuminated signs.

C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.

D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:

1. Panel Signs: Full-size Samples of each type of sign required.
2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter and number) required. Show character style, material, finish, and method of attachment.
3. Show graphic style, and colors and finishes of letters, numbers, and other graphic devices.
4. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
5. Approved samples will be returned for installation into Project.

E. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.
   1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction.

B. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

C. Source Limitations: Obtain each sign type through one source from a single manufacturer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.
   1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

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 manufacturers indicated.
   1. Provide signs based on Identity Group, ADA Signs.

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. Fast Signs

C. Manufacturers of Cast Metal Plaques: Subject to compliance with requirements, provide products by one of the following:

1. A.R.K. Ramos.
2. American Graphics Inc.
3. Gemini Incorporated.
4. Metal Arts; Div. of L&H Mfg.
5. Mills Manufacturing, Inc.

2.2 MATERIALS

A. Cast-Acrylic Sheet: Cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet; sizes and thicknesses indicated; minimum flexural strength of 16,000 psi when tested according to ASTM D 790; minimum allowable continuous service temperature of 176 degrees F.
1. Clear sheet: Colorless transparent sheet, matte finish, with light transmittance of 92 percent when tested per ASTM D 1003.
2. Colored opaque acrylic sheet.

B. Colored Coatings for Acrylic Sheet: Use coatings, inks and paints for copy and background colors that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for application intended.
1. Custom match background colors indicated on finish legend, or if not indicated, match Architect's samples.
2. For reverse engraved text color, match embedded text color.

C. Vinyl Text Inserts: White stock as recommended by sign manufacturer with black text for changeable text fields. Text to match Owner's requirements, as marked on submittals.

D. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 5005-H15.

E. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 6063-T5.

F. Abrasion-Resistant, Monolithic Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating.
1. Translucent Sheet: White polycarbonate sheet of density required to produce uniform brightness and minimum halation effects.

2.3 PANEL SIGNS

A. Design Concept: The Drawings and signage schedules indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated.

B. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.

C. Graphic Content and Style: Provide sign copy that complies with requirements indicated for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.
   1. Signs that designate permanent rooms and spaces and signs that provide direction to or information about functional spaces (and other signs required to comply) shall comply with the ADA.

D. Frameless Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:
   1. Edge Condition: Square edge.
   2. Corner Condition: Square.
   3. Panel thickness: 1/8 inch.
   4. Panel finish: Matte.
   5. Letter Style: As selected by Architect.

E. Backing: Permanently laminate face panels to backing sheets of material and thickness indicated using the manufacturer's standard process where required by fabricating process or mounting methods, or where otherwise indicated.

F. Panel Sign Copy Process and Materials: Provide surface applied copy for text, graphics and braille required to comply with the ADA. Provide reverse-engraved graphics and text for graphics not required to comply with ADA.
   1. Engraving: Form recesses by machine-engraving letters, numbers, symbols, and other graphic devices into sign panel on the face indicated to produce precisely formed copy, incised to uniform depth. Use high-speed cutters mechanically linked to master templates in a pantographic system or equivalent process capable of producing characters of the style indicated with sharply formed edges.
      a. Face-Engraved Copy for Embedded Text: Engrave copy to produce a minimum indentation depth of 1/32 inch.
         1) Embed raised copy as specified below, apply opaque background color coating to back face of acrylic sheet.
      b. Rasterball for Braille: Accurately drill indentations to receive braille raster balls so raster balls protrude as required from face.
      c. Reverse Engraved Copy: Engrave as above on reverse side of panel.
         1) Clear acrylic sheet: Fill engraved copy with enamel. Apply opaque background color coating to the back face of acrylic sheet.
   2. Raised Copy: Machine-cut copy characters to fit recesses from white matte-finished opaque acrylic sheet and chemically weld into the acrylic sheet recesses forming

embedded text sign panel face. Produce precisely formed characters with cut edges free from burrs and cut marks.
   a. Raised copy thickness: 1/16 inch.
   b. Form braille by fusing clear raster balls to drilled holes.
3. Raised Copy: Machine-cut copy characters from white matte-finished opaque acrylic sheet and adhesively bonded onto the acrylic sheet forming text sign panel face. Produce precisely formed characters with cut edges free from burrs and cut marks.
   a. Raised copy thickness: 1/16 inch.
   b. Form braille by fusing clear raster balls to drilled holes.

2.4 DIMENSIONAL CHARACTERS

A. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Cast Characters for Interior Building Signs: Form individual letters and numbers by casting. Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.
   1. Material: Aluminum.
   2. Character Depth: 1 inch.
   3. Font: Arial
   4. Character Style: As selected by Architect.
   5. Letter Height: As indicated on the drawings.
   6. Finish: Clear anodized.

2.5 CAST-METAL PLAQUES

A. General: Provide castings free from pits, scale, sand holes, and other defects. Comply with requirements specified for metal, border style, background texture, and finish and in required thickness, size, shape, and copy.

B. Size: 24 by 36 inches.

C. Text: Allow for one letter of text per square inch of space, with wording furnished by Architect.

D. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

E. Border Style: As selected by Architect.

F. Background Texture: As selected by Architect from manufacturer's standard textures.

G. Mounting: Concealed studs for substrates encountered.

2.6 ACCESSORIES

A. Mounting Methods for Panel Signs: Use silicone adhesive fabricated from materials that are not corrosive to sign material and mounting surface.

B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.7 ALUMINUM FINISHES

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 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 range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

D. Clear Anodic Finish: Manufacturer's standard clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:
   1. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.
   2. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

C. Glass-Mounted Panel Signs: Where panel signs are mounted on glass, use double-sided adhesive tape recommended by sign manufacturer. Provide matching plate on opposite side of glass to conceal mounting materials, aligned with sign and applied with double-

sided tape, using blank panel of same material and color as sign panel unless otherwise indicated.

1. Where blank panel is located on exterior of building, provide 0.050 inch thick aluminum sheet of size and shape matching sign panel, finished to match adjacent aluminum framing.

D. Dimensional Characters: Mount characters using standard fastening methods recommended in writing by manufacturer for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Projected Mounting: Mount characters at projection distance from wall surface indicated.
2. Flush Mounting: Mount characters with backs in contact with wall surface.

E. Cast-Metal Plaques: Mount plaques using standard fastening methods recommended in writing by manufacturer for type of wall surface indicated.

1. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 21 13 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes toilet compartments and screens as follows:
   1. Type: Solid-plastic, polymer resin.
   2. Compartment Style: Overhead braced and floor anchored.
   3. Screen Style: Wall hung.

B. Related Sections include the following:
   1. Division 10 Section "Toilet Accessories": Toilet paper holders, grab bars, and similar accessories.

1.2 SUBMITTALS

A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available.

D. Samples for Verification: Of each compartment or screen color and finish required, prepared on 6-inch-square Samples of same thickness and material indicated for Work.

1.3 QUALITY ASSURANCE

A. Accessibility: Comply with applicable requirements of the Americans with Disabilities Act "Accessibility Guidelines" (ADAAG), together with ANSI A117.1 "Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People."

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation 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, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: The design for toilet compartments is based on products and colors of ASI Global. Subject to compliance with requirements, provide comparable products by one of the following:
   1. Bobrick Washroom Equipment
   2. Scranton Products
   3. Bradley Corporation: Mills Partitions

2.2 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

B. Solid-Plastic, Polymer Resin: High-density polyethylene (HDPE) with homogenous color throughout. Provide material not less than 1 inch thick with seamless construction and eased edges in color and pattern as follows:

C. Colors: One color in each room as indicated by manufacturer's designations in Finish Legend on the Drawings.

D. Pilaster Shoes and Sleeves (Caps): Manufacturer’s standard polymer.
   1. Polymer color and pattern: Matching pilaster.

E. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:
   1. Material: Stainless steel.

F. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:
   1. Material: Stainless steel.

G. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.

H. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip in manufacturer's standard finish.

I. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

B. Solid-Plastic, Polymer-Resin Compartments and Screens: Provide aluminum heat-sink strips at exposed bottom edges of HDPE units to prevent burning.

C. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

D. Wall-Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels, unless otherwise indicated.

E. Doors: Unless otherwise indicated, provide 27-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments indicated to be handicapped accessible.
   1. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position.
   2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
   3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
   4. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
   5. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch between pilasters and panels and not more than 1 inch between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.
   1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2

fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING AND CLEANING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10 21 13

SECTION 10 21 23 – CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Curtain tracks and curtain carriers.
   2. Cubicle curtains.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry": Wood blocking for mounting items requiring anchorage.
   2. Division 09 Section "Acoustical Ceilings": Metal framing and supports for mounting items requiring anchorage.

1.2 PERFORMANCE REQUIREMENTS

A. Curtains: Provide curtain fabrics with the following characteristics:
   1. Fabrics are launderable to a temperature of not less than 160 deg F.
   2. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
      a. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

1.3 SUBMITTALS

A. Product Data: Include durability, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.
   1. Include data on each type of applied curtain treatment.

B. Shop Drawings: Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
   1. Include details on blocking above ceiling and in walls.

C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
   1. Ceiling suspension assembly members.
   2. Method of attaching track hangers to building structure.
   3. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.

D. Samples for Initial Selection: For each type of curtain fabric indicated.

E. Samples for Verification: Full-size units of each type of the following products:

1. Curtain Fabric: 12-inch-square swatch or larger Sample as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
2. Mesh Top: Not less than 4 inches square.
3. Curtain Track: Not less than 4 inches long.
4. Curtain Carrier: Full-size unit.

F. Product Certificates: Signed by manufacturers of tracks and curtains certifying that products furnished comply with requirements.

G. Maintenance Data: For tracks and curtains to include in maintenance manuals specified in Division 01.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install cubicle curtains 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. Field Measurements: Where cubicles are 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ADC Hospital Equipment, Division of Automatic Devices Company.
2. Creative Healthcare Products Inc.
3. General Cubicle Company Inc.
4. Kirsch.
5. A. R. Nelson Co.

B. Basis of Design Curtain Product: As indicated on Drawings.

2.2 CURTAIN TRACKS

A. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4 inch high; with minimum wall thickness of 0.058 inch.
1. Curved Track: Factory fabricated 12-inch radius bends.
2. Finish: Baked enamel, acrylic, or epoxy.
3. Color: As selected by Architect from manufacturer's full range.

B. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

C. Curtain Carriers: One-piece nylon glide with chrome-plated steel hook.

D. Concealed Fasteners: Stainless steel.

2.3 CURTAINS

A. Curtain Fabric: Provide fabric product, color and pattern as indicated on Drawings Mesh Top: Manufacturer's standard nylon mesh.

B. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.

C. Curtain Track: Nickel plated brass chain; one at each curtain termination

2.4 CURTAIN FABRICATION

A. Fabricate curtains to comply with the following requirements:
1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.
2. Length: Equal to floor-to-ceiling height, with 20-inch mesh top, and minus 12-inch distance above finished floor.
3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched.
4. Mesh Top: Top hem not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.
5. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced, and double lock stitched.
6. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with triple turned edges, and single lock stitched.
7. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions.
1. Curtain Track Mounting: Surface.

B. Surface Track Mounting: Fasten surface-mounted tracks at intervals of not less than 24 inches. Fasten support at each splice and tangent point of each corner. Attach track to suspended ceiling grid with manufacturer's proprietary clip.

C. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

D. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along the full length of the curtain plus an additional carrier.

E. Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

END OF SECTION 10 21 23

SECTION 10 22 26 - OPERABLE PARTITIONS

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. Manually operated, individual panel operable partitions.
   2. Manually operated, paired panel operable partitions.
   3. Electrically operated, continuously hinged partitions.

B. Related Sections include the following:
   1. Division 03 Sections for concrete tolerances required.
   2. Division 05 Sections for primary structural support, including pre-punching of support members by structural steel supplier per operable partition supplier's template.
   3. Division 06 Sections for wood framing & supports, and all blocking at head and jambs as required.
   4. Division 09 Sections for wall and ceiling framing at head and jambs.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.

D. The operable wall must be manufactured by a certified ISO-9001-2015 company or an equivalent quality control system.

E. Indoor Air Quality: Operable partition, movable wall manufacturer’s non-wood products must meet the SCS Indoor Advantage™ Gold Certification or equivalent. This approval guarantees conformance to indoor air concentrations meeting Indoor Advantage Gold Indoor Air Quality Certified to SCS-105 v4.2-2023 Conforms to ANSI/BIFMA M7.1 and X7.1 and the CDPH/EHLB Standard Method (CA 01350) v1.2-2017 conducted in an independent third-party air quality testing laboratory.

1.4 REFERENCE STANDARDS

A. ASTM International
   1. ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.
   2. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   3. ASTM C1036 - Standard Specification for Flat Glass.
   4. ASTM C1048 - Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
   5. ASTM E84 - Surface Burning Characteristics of Building Materials.
   6. ASTM E413 - Classification for Rating Sound Insulation

B. Health Product Declaration Collaborative
   1. Health Product Declaration Open Standard v2.1

C. International Standards Organization
   1. ISO 14021 - Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labeling).
   2. ISO 14025:2011-10, Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures.
   3. ISO 14040:2009-11, Environmental Management - Life Cycle Assessment - Principles and Framework.
   4. ISO 14044:2006-10, Environmental Management - Life Cycle Assessment - Requirements and Guidelines.
   5. ISO 21930 – Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services.

D. Other Standards
   1. ADA – Americans with Disabilities Act.
   2. UL 508A – Standard for Industrial Control Panels
   3. NFPA 70 – National Electrical Code
   4. ANSI Z97.1 - Safety Glazing Materials Used in Buildings.
   5. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
   6. NEMA LD3 - High Pressure Decorative Laminates.

1.5 SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

B. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

C. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

D. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.

E. Reports: Provide a complete and unedited written sound test report indicating test specimen matches product as submitted.

F. Create spaces that are healthy for occupants.
   1. Furnish products and materials with Health Product Declaration (HPD), Manufacturer Inventory, or other material health disclosure documentation. Products without an HPD or other disclosure documentation are not acceptable.

G. Furnish materials that generate the least amount of pollution.
   1. Furnish products and materials that have third party verified environmental product declarations (EPD's). Consider products and materials that have optimized environmental performance (reduced life cycle impacts). Products without an EPD or other disclosure documentation are not acceptable.

H. Buy American: Folding door to be manufactured in the United States in compliance with applicable U.S. Federal Trade Commission (FTC) and U.S. Customs Service and Border Protections regulations and be labeled "Made in America".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

C. Panels to be unloaded, and inspected prior to installation, by operable wall installers.

1.7 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.

B. Partition Warranty: Eight (8) years

C. Suspension System Warranty: Ten (10) years.

D. Hinge Warranty: Lifetime Warranty on all hinges

PART 2 – PRODUCTS

2.1 MANUFACTURERS, PRODUCTS, AND OPERATION

A. Manufacturers: Subject to compliance with requirements, provide product by the following:
   1. Modernfold, Inc.
   2. Hufcor Inc.
   3. Industrial Acoustics Co.

B. Operable Partition and Pocket Doors to be manufactured in the U.S.A.

C. Basis of Design: Subject to compliance with the requirements, provide the following product:
   1. OP-01 C103 Gym: Acousti-Seal Legacy – Electric Partition (933E) electrically operated continuously hinged operable partition.

   2. OP-02 B200 LGI: Acousti-Seal Legacy – Paired Panel (932) manually operated paired panel operable partition.

   3. OP-03 D102 Platform: Acousti-Seal Legacy – Single Panel (931) manually operated individual panel operable partition.

2.2 OPERATION

A. C103 Gym: Acousti-Seal Legacy – Electric Partition (933E): Series of continuously hinged flat panels, electrically operated, top supported with operable floor seals.

B. B200 LGI: Acousti-Seal Legacy – Paired Panel (932): Series of paired flat panels hinged together in pairs, manually operated, top supported with operable floor seals.

C. D103 Platform: Acousti-Seal Legacy – Single Panel (931): Series of individual flat panels, manually operated, top supported with operable floor seals.

D. Final Closure:
   1. C103 Gym: Side Jamb with overlapping trail panel.
   2. B200 LGI: Horizontally expanding panel edge with removable crank
   3. D102 Platform: Horizontally expanding panel edge with removable crank

E. Electric partition shall be operated by:
   1. Two push button control stations wired in series and located on opposite sides and opposite ends of the partition. Control stations shall be activated by key switch at stack end of partition.
   2. Motor unit shall be reversible, continuous duty, and class A insulated. Motor unit shall have NEMA MG 1 service factor, high starting torque, thermal overload protection, and open/drip proof enclosure. Motor assembly shall have wiring compliant with NFPA 70, 24-volt controls, compliant with UL 508A, and speed of 28 feet/minute. The drive unit motor shall be equipped with outboard limit

switches to prevent over-extension. A positive chain drive attached to the lead panel shall pull the partition across the opening. Cable, belt, or other friction type drives will not be accepted.

F. Electric motor shall be:
   1. 208-volt, 3-phase

2.3 PANEL CONSTRUCTION

A. C103 Gym: Nominal 3-inch (76mm) thick panels in manufacturer's standard 48-inch (1220mm) widths. All panel horizontal and vertical framing members fabricated from minimum 16-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.

B. Panel skin shall be:
   1. C103 Gym: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum:
      a. 50 STC
   2. B200 LGI: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum:
      a. 52 STC
   3. D102 Platform: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum:
      a. 50 STC

C. Hinges for Closure Panels, Pass Doors, and Pocket Doors shall be:
   1. Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.

D. Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove appearance at panel joints.

E. Panel Weights:
   1. C103 Gym: 50 STC - 8 lbs./square foot
   2. B200 LGI: 52 STC - 11 lbs./square foot
   3. D102 Platform: 50 STC - 8 lbs./square foot

2.4 PANEL FINISH

A. Panel finish shall be:
   1. Reinforced heavy duty vinyl with woven backing weighing not less 30 ounces (850 grams) per lineal yard.

B. Panel Trim & Hinges: Exposed panel trim of one consistent color:
   1. To Be Advised, from operable partition manufacturers currently available colors.

2.5 SOUND SEALS

A. Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.

B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts

C. Horizontal bottom floor seals shall be:
   1. C103 Gym: Floating Bottom Seal. Floating operable seals provide nominal 3-1/2 inch (89 mm) operating clearance within operating range of +1/2-inch (15 mm) to –3-inch (76 mm) and shall provide continuous floor contact as panels are positioned with no need for tools or cranks.
      a. Swivel casters (hard surface flooring)
   2. B200 LGI: A2 - Automatic operable seals providing nominal 2-inch (51 mm) operating clearance with an operating range of +1/2-inch (13 mm) to –1-1/2 inch (38 mm) which automatically drop as panels are positioned, without the need for tools or cranks.
   3. D102 Platform: A2 - Automatic operable seals providing nominal 2-inch (51 mm) operating clearance with an operating range of +1/2-inch (13 mm) to –1-1/2 inch (38 mm) which automatically drop as panels are positioned, without the need for tools or cranks.

2.6 SUSPENSION SYSTEM

A. C103 Gym: #14 Suspension System
   1. Suspension Tracks: Minimum 7-gage, 0.18-inch (5 mm) roll-formed steel. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 1/2-inch (13 mm) diameter threaded rods. Brackets must support the load bearing surface of the track.
      a. Exposed track soffit: Steel, removable for service and maintenance, attached to track bracket without exposed fasteners, and pre-painted off-white.
   2. Carriers: All-steel trolleys with steel-tired ball bearing wheels.

B. B200 LGI: #17 Suspension System
   1. Suspension Tracks: Minimum 11-gauge, 0.12-inch (3.04mm) roll-formed steel track, suitable for either direct mounting to a wood header or supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 0.38-inch (10mm) diameter threaded rods. Aluminum track is not acceptable.
      a. Exposed track soffit: Steel, integral to track, and pre-painted off-white.

2. Carriers: One all-steel trolley with steel tired ball bearing wheels per panel (except hinged panels). Non-steel tires are not acceptable.

C. D102 Platform: #17 Suspension System - “Smart Track™”
   1. Suspension Tracks: Minimum 11-gauge, 0.12-inch (3.04mm) roll-formed steel track, suitable for either direct mounting to a wood header or supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 0.38-inch (10mm) diameter threaded rods. Aluminum track is not acceptable.
      a. Programmable “soft curve” weldment. Right-Angle weldment is not acceptable.
      b. Exposed track soffit: Steel, integral to track, and pre-painted off-white.
   2. Carriers: Two all-steel trolleys with steel tired ball bearing wheels. Non-steel tires are not acceptable. Suspension system shall provide automatic indexing of panels into stack area using preprogrammed switches and trolleys without electrical, pneumatic, or mechanical activation.

2.7 OPTIONS

A. Available accessories/options:
   1. C103 Gym: Pocket Doors: Acousti-Seal Pocket Doors by Modernfold, Inc. Equipped with electric interlock system. (see supplement specification)
      a. Legacy pocket door

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

3.2 CLEANING AND PROTECTION

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer’s written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.3 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 DEMONSTRATION

A. Demonstrate proper operation and maintenance procedures to Owner's representative.

B. Provide Operation and Maintenance Manual to Owner's representative.

END OF SECTION 10 22 26

SECTION 10 28 13 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Toilet accessories as scheduled.
   2. Janitor closet accessories.

B. This Section includes installation of the following accessories furnished by Owner:
   1. Toilet tissue dispensers.
   2. Towel dispensers.
   3. Soap dispensers.

C. This Section includes providing the following:
   1. Grab bars.
   2. Framed mirrors.
   3. Sanitary napkin disposal units.

D. Related Sections include the following:
   1. Division 10 Section "Toilet Compartments": Compartments and screens.
   2. Division 22 Sections: Plumbing fixtures

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

C. Maintenance Data: For accessories to include in maintenance manuals. Provide lists of replacement parts and service recommendations.

1.3 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.
   1. Products of other manufacturers with equal characteristics, as judged solely by Architect, may be considered. See Division 01 Section "Product Requirements" regarding substitution procedures.

2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Regulatory Requirements: Comply with provisions Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)" for manufacture and installation of toilet accessories.

D. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

1.4 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, 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. 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. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.
1. Minimum Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Provide models by Bobrick Washroom Equipment, Inc. as indicated for each product in the Schedule at the end of Part 3.
1. Comparable Manufacturers of Toilet Accessories: Subject to compliance with requirements, provide the named products or comparable products by one of the following:
a. American Specialties, Inc.
b. Bradley Corporation.
c. McKinney/Parker Washroom Accessories Corp.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Sheet Steel: ASTM A 366, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

C. Galvanized Steel Sheet: ASTM A 653, G60.

D. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

E. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

F. Vitreous Enamel Finish: Manufacturer's standard fired-on vitreous finish over cast iron.

G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

H. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. General: One, maximum 1-1/2-inch- diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
   1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

F. 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. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET ACCESSORY SCHEDULE

A. General: Where designations below are indicated on Drawings, provide the toilet accessory item complying with specified requirements.

B. Toilet Tissue Dispenser, Wall Mounted:
1. Furnished by Owner, Contractor installed.
2. Mounting: Surface mounted with concealed anchorage.
3. Locations: One per single occupant toilet room, and one per toilet stall.

C. Grab Bar:
1. Basis-of-Design Product: Bobrick B-68137. / B-6806.
2. Description: Stainless-steel grab bar in one piece configurations shown.
3. Sizes: Unless otherwise indicated or necessary to suit conditions, provide one unit 36 inches long, one unit 48 inches long and one minimum 18” vertical at each water closet. ‘L’ shaped grab bar for shower unit.
4. Stainless-Steel Nominal Thickness: Minimum 0.05 inch.
5. Mounting: Concealed with manufacturer's standard flanges and anchors.
6. Gripping Surfaces: Peened slip-resistant texture.

7. Outside Diameter: 1-1/2 inches.

D. Paper Towel Dispenser / Waste Receptacle:
1. Basis-of-Design Product: Bobrick B-270.
2. Description: Stainless-steel recessed dual paper towel and waste receptacle.
3. Locations: As indicated on Drawings.

E. Mirror Unit:
1. Basis-of-Design Product: Bobrick B-165.
2. Stainless-Steel, Channel-Framed Mirror: Fabricate frame from stainless-steel channels in manufacturer's standard satin or bright finish with square corners mitered to hairline joints and mechanically interlocked.
3. Mirror Size: 18-by-36 inches, unless otherwise indicated.

F. Soap Dispenser:
1. Furnished by Owner, Contractor installed
2. Locations: As indicated and at each sink.

G. Sanitary Napkin Disposal Unit, Partition-Mounted:
1. Basis-of-Design Product: Bobrick B-354.
2. Description: Stainless-steel sanitary napkin disposal.
3. Partition-Mounted, Dual-Access Type: With adjustable flanges for partition mounting to serve two toilet compartments; self-closing door; and reusable receptacle that is removable from one side.
4. Locations: As indicated on Drawings.

H. Recessed Changing Station:
1. Basis-of-Design Product: Koala Kare, KB310-SSRE.
2. Description: Wall recessed plastic child changing station.
3. Locations: As indicated on Drawings.

I. Adult Changing Station:
1. Basis-of-Design Product: Koala Kare, KB3000.
2. Description: Plastic wall mounted adult changing station.
3. Locations: As indicated on Drawings.

J. Clothes Hook:
1. Basis-of-Design Product: Bobrick B-233.
2. Single-Prong Unit: Stainless-steel, welded-plate type hook with square wall bracket and backplate for exposed mounting.
3. Finish: Stainless steel with satin finish.
4. Quantity: Provide two units at each location designated for a hook.

K. Mop and Broom Holder with Shelf:
1. Basis-of-Design Product: Bobrick B-239x34.
2. Mop and Broom Holder with Utility Shelf: 34-inch- long unit fabricated of minimum nominal 0.05-inch- thick stainless steel with shelf; support brackets for wall mounting; four hooks for wiping rags; three spring-loaded, rubber hat, and cam-type, mop/broom holders mounted on front of shelf.
3. Locations: Provide one unit in each janitor's closet.

END OF SECTION 10 28 13

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Portable fire extinguishers.
   2. Fire-protection cabinets for portable fire extinguishers.
   3. Defibrillator and cabinets.
   4. Fire extinguisher mounting brackets.
   5. Furnishing fireman's key boxes.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry": Installation of wall-mounted fireman's key box.
   2. Division 26 Sections: Building alarm system connections for fireman's key boxes.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
   1. Fire Extinguishers: Include rating and classification.
   2. 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. Samples for Verification: For exposed cabinet finishes, in sets showing the full range of variations expected.
   1. Size: 6-by-6-inch-square Samples.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide extinguishers listed and labeled by FM.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers of Fire Extinguishers, Cabinets and Accessories: Subject to compliance with requirements, provide products by one of the following:
   1. J.L. Industries, Inc.
   2. Larsen's Manufacturing Company.
   3. Potter-Roemer; Div. of Smith Industries, Inc.
   4. Watrous; Div. of American Specialties, Inc.

B. Manufacturer of Defibrillator and Cabinet: Subject to compliance with requirements, provide products by the following:
   1. Medtronic Physio-Control, Redmond WA, (425) 867-4000 (JL Industries, Inc.).

C. Manufacturer of Fireman's Key Box: Subject to compliance with requirements, provide products by the following:
   1. Knox Manufacturing Inc.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366, commercial quality, stretcher leveled, temper rolled.

B. Stainless-Steel Sheet: ASTM A 666, Type 302 or Type 304 alloy.

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Typical Locations: Multipurpose dry-chemical type; UL-rated 4A:80B:C, 10-lb nominal capacity, in enameled-steel container.

C. Kitchen Locations: Wet-chemical type; UL-rated for Class K fires, not less than 16 pound, 6 liter capacity; in stainless-steel container; with pressure-indicating gage.
   1. Locations: Provide for kitchen locations as indicated on Drawings; or if not indicated, provide one bracket mounted fire extinguisher for each separate cooking line, in location directed by Architect.

2.4 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
   1. Cabinet Metal: Enameled-steel sheet.

B. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
   1. Applications: Provide recessed cabinets unless wall thickness cannot accommodate full depth of cabinet.
   2. 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) of 1/4 to 5/16 inch.

C. Cabinet Door and Trim Material: Stainless steel sheet.

D. Door Style: Fully glazed panel with frame.

E. Door Glazing: Tempered float glass (clear).

F. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
   1. Hollow-Metal Design: Minimum 1/2-inch-thick door frames, fabricated with tubular stiles and rails.

G. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.5 DEFIBRILLATOR AND CABINET

A. General: Provide cabinets designed for use with emergency defibrillator "LIFEPAK 1000 AED" with graphic display by Physio-Control Inc.
   1. Locations: Provide one cabinet with AED in location indicated, or if not indicated, as directed by Architect.

B. Physio-Control LifePak® 1000: A battery powered automated external defibrillator (AED) meeting the current American Heart Association recommendation of providing escalating energy from 150 to 360 joules. The device should be user programmable for energy levels, have automatic rhythm analysis capability, and deliver a biphasic waveform discharge that is impedance adjusted to the patient.
   1. AED to include interchangeable electrode pads
   2. AED to include universal data management interchangeability
   3. AED to include preconnected electrode cables
   4. AED to include motion detection safety

C. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
   1. Cabinet Metal: Enameled-steel sheet.
   2. Interior Dimensions: 14 by 14 inches by 7 inches deep.

D. Cabinet Mounting: Suitable for the following mounting conditions:
   1. Semirecessed: Cabinet box partially recessed in wall.
   2. Return Dimension: 3 inches.

E. Door Style: Fully glazed panel with frame.
   1. Door Glazing: Flat, clear acrylic sheet.

F. Door Hardware: Provide manufacturer's standard door-operating hardware including exposed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

G. Cabinet Alarm: Equip cabinet with manufacturer's standard alarm that can be disarmed with key lock.

H. Cabinet Accessories: Provide standard labeling, one AED wall placard, and CPR/AED wall poster.

2.6 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.
   1. Provide brackets for wall-mounted extinguishers and for extinguishers located in cabinets.

B. Lettered Door Handle: Provide one-piece, cast-iron door handle with the word "FIRE" embossed into face.

C. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.

D. Fireman's Key Box: Provide one unit complying with the following, in locations directed by Architect.
   1. Product: Knox-Box 3200 Series Recessed Mount with Recessed Mounting Kit (RMK); Knox Company, Irvine CA, (800) 552-5669.
   2. Product: Knox-Box 3200 Series; Knox Company, Irvine CA, (800) 552-5669, and as follows:
      a. Gate-Mounted Unit: Surface Mount.
      b. Building-Mounted Unit: Recessed Mount with Recessed Mounting Kit (RMK).
   3. Construction: 1/4 inch plate steel housing, 1/2 inch thick steel door with interior gasket seal.
   4. Capacity: Capable of storing 10 standard keys and 4 elevator keys.
   5. Exterior Finish Color: Aluminum.
   6. Keying and Security: Prepare unit with keying standardized according to requirements of authorities having jurisdiction
      a. Equip wall-mounted unit with UL Listed tamper switches prepared for connection to building alarm system.

2.7 FINISHES

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. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

E. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
   1. Color: As selected by Architect from manufacturer's standard range.
   2. Provide manufacturer's standard baked-enamel paint for the following:
      a. Interior of cabinet.
      b. Exterior of cabinet door and trim.

F. Stainless Steel Door Finish: Bright, directional polish; No. 4 finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking.

B. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
   1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
   2. Fasten mounting brackets to structure and cabinets, square and plumb.
   3. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10 44 00

SECTION 10 75 00 - 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 11 40 00 - FOODSERVICE EQUIPMENT

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. Provide all material, labor, equipment and services required to execute and complete all items of work relating to the food service equipment, both existing and new, all as required to make the resulting facility a fully functional and reliable operating unit in accordance with this Specification. All food service equipment shall be furnished as specified, delivered prepaid, unloaded and uncrated, assembled with all components and accessories connected within the equipment, set-in-place in proper location as indicated on the drawings, leveled and fastened to the wall, ceiling or floor as required, left ready for final utility connections. The work shall include:

1. To prevent extended warehousing of all food service equipment, no pre-ordering of equipment is permitted; schedule ordering of the equipment so that warehousing of the equipment shall not be required for longer than 60 days prior to delivery to the site for installation.
2. All food service equipment shall have a manufacturer extended warranty covering parts and labor for a period of two years which shall take effect only after acceptance and beneficial use by the District. All labor shall be performed by a factory authorized and qualified representative.
3. A “complete and thorough” demonstration and start-up for each item of equipment must be conducted by a qualified manufacturer representative in the use, sanitation and maintenance of the equipment.

B. Furnishing scheduled items of custom fabricated food service equipment as specified utilizing a food service equipment fabricator listed with the National Sanitation Foundation (NSF) for custom equipment fabrication.

C. Delivery of food service equipment in factory fabricated containers designed to protect equipment and finish until final installation. Delivery of food service equipment shall be coordinated with the construction schedule. If necessary, delivery of the food service equipment shall be by means other than common carrier to expedite delivery and to maintain project schedule.

D. Warehousing of the food service equipment in a bonded warehouse and re-delivery of the food service equipment from the storage facility to the project site or arrangement for secured storage at the project site to assure availability of the food service equipment to maintain project schedule.

E. Field installation of the food service equipment including buy out equipment at the project site including on site receiving and unloading, uncrating from packing containers, conveyance of the food service equipment from the receiving area to the installation location, erection and assembly of the food service equipment including field welding and polishing of sub assemblies and installation of fixtures and components and setting in place in final location.

F. Removal and disposal of discontinued items of food service equipment not to be reused including costs for transport and scrapping. This shall include pump-down and reclaim of refrigerant and fire system propellant and disposal costs of all refrigeration systems as required. Utility disconnection and termination of utility services shall be provided by the Plumbing, Electrical and Mechanical (HVAC) Trades.

G. Removal and disposal of discontinued items of food service equipment not to be reused including costs for transport and scrapping. This shall include pump-down and reclaim of refrigerant and disposal costs of all refrigeration systems as required. Utility disconnection and termination of utility services shall be provided by the Plumbing, Electrical and Mechanical (HVAC) Trades.

H. Removal, cleaning, servicing, reassemble and reinstallation of items of food service equipment to be reused including warehousing and transportation costs for scheduled items of food service equipment to be refurbished off-site or to be temporarily stored off-site. This shall include pump-down and reclaim of refrigerant and disposal costs of all refrigeration systems as required. Utility disconnection and termination of discontinued services and modification or preparation or relocated utility services shall be provided by the Plumbing, Electrical and Mechanical (HVAC) Trades.

I. Removal, cleaning, servicing, crating and delivery including costs for transport of items of food service equipment to be reused in an alternate location. This shall include pump-down and reclaim of refrigerant and disposal costs of all refrigeration systems as required. Utility disconnection and termination of utility services shall be provided by the Plumbing, Electrical and Mechanical (HVAC) Trades.

J. Removal and disposal of all packing material.

K. All costs for special tools, crane rental or usage cost or rigging as may be required for delivery or installation of the food service equipment.

L. All work is to be performed by skilled labor utilizing the proper Trades having respective jurisdiction thereto. All work shall be performed at hours required to maintain consistent work schedules with all other Trades without additional cost.

M. Preparation of dimensioned utility rough-in floor plans coordinated with the Contract Documents and site conditions and the food service equipment manufacturers' utility connection points for all food service equipment.

N. Assist in the preparation of "chalk-line" mark-up of utility rough-in locations on the building floor at the job site.

O. Take complete financial responsibility for any and all additional expenses resulting from incomplete or inaccurate rough-in drawings or instructions for the final rough-in dimensioning at the job site.

P. Provide complete manufacturers' and fabricator shop drawings of all related items of food service equipment.

Q. Provide competent on site supervision for the coordination of work and to assist and supervise the erection, assembly and installation of the food service equipment, this shall include any moving, shifting or disassembly of the food service equipment to enable work to be performed free of obstruction.

R. Attend all job conferences and meetings.

S. Maintaining coordination and control over the form, fit, function and utility requirements of all food service equipment, from placement of purchase orders through Final Acceptance

T. Provide competent on-site final testing, demonstration and instruction in the use and service of all items of food service equipment in the form of a qualified manufacturer's representative for each item of food service equipment.

U. Providing access to the custom equipment fabricator's shop for inspection of construction and materials used at any time during the progress of fabrication.

V. Field verification of all measurements at the project site prior to the fabrication of custom fabricated and buy-out equipment and correct any deviation from the dimensions indicated on any plans and shop drawing which may affect the final form or fit of any item of food service equipment as a result of final building conditions and actual field dimensions.

W. All food service equipment shall conform to field verified dimensions and to the finished building conditions with edges scribed and sealed to wall surfaces, fitting to and around building obstructions. All joints, seams or surfaces shall be fully sealed with General Electric or equivalent clear silicone sealer.

X. Field verification of delivery access into and through the building to the final equipment location including access and clearance through hallways, doorways and elevators (cab size and weight restrictions); furnish food service equipment in sections or sub-assemblies as required for access.

Y. Keeping the premise free from accumulation of waste material and rubbish caused by his work. At the completion of each workday all waste material and rubbish must be removed and all areas swept broom clean.

Z. Physical damage to equipment, building or previous work completed or in the process of completion shall be repaired or replaced.

AA. Furnish as part of and affixed to the food service equipment, accessories, components and fixtures furnished standard with the equipment as specified or listed as an option and shall include the following:

1. PLUMBING ACCESSORIES: Pop-up, lever or basket type waste outlets, tailpieces, standing or connected overflows, faucets and spray units, vacuum breakers, shut-off and control valves and fittings.
2. STEAM AND GAS ACCESSORIES: Steam supply valves, thermostats, pressure reducing and regulating valves, shut-off and control valves, temperature and pressure gauges, copper steam coils or injector assemblies, traps and fittings
3. ELECTRICAL ACCESSORIES: Terminal blocks, conduit, wiring, signal and pilot lamps, on-off and control switches, control panels, magnetic contactor assemblies, heating elements, junction boxes, outlet boxes and receptacles and cord and plug sets.
4. REFRIGERATION ACCESSORIES: Copper insulated refrigeration tubing, valves, fittings, hangers, high and low pressure control switches, solenoid valves, evaporator coils, expansion valves, condensing units and condensate evaporators.

BB. All built-in accessories, components and fixtures shall be factory installed at the time of fabrication and shall comply with all applicable codes and regulations.

CC. Furnish and install copper insulated refrigeration lines from compressor location to evaporator coils and expansion valves for all refrigeration units and ice makers with remote or refrigeration systems other than self-contained.

DD. Furnish and install flexible stainless steel gas flue tubing from exhaust collar on gas hot water booster heater terminating at the exhaust vent connection at the vent extension or condensate hood.

EE. Furnish 14 gauge galvanized steel welded roof curbs for all refrigeration condensing unit stands and exhaust fans and supply fan make-up air units including setting-in-place and securing to the building roof.

FF. Furnish and install in exhaust hood, plenum, duct and surface fire protection system. Entire system shall be furnished and installed in compliance with UL Standard 1254, UL Standard 300, NFPA 96 and any prevailing statutes or codes including automatic shut-down of all cooking appliances per code section 44 of NFPA 17A-27. The manufacturer of the fire suppression system shall be ISO 9001 registered. The entire installation must conform to ADA (American Disabilities Act) latest edition. The system shall be an automatic fire suppression system using a wet chemical agent for grease related fires. The system shall be the pre-engineered type having minimum and maximum guidelines established by the manufacturer and listed by Underwriters Laboratories (UL). The system shall be installed and serviced by certified personnel trained by the manufacturer. Provide as part of fire system, mechanically operated gas supply line shut-off valve to interrupt gas supply to all gas operated cooking appliances. Gas valve shall be provided with manual reset to prevent gas flow to pilot devices on appliances prior to restart.

GG. Furnish and install remote and self-contained refrigeration system complete with Copeland condensing unit and insulated copper refrigeration lines charged with R404A refrigerant. Condensing unit shall be interconnected to a low profile, high velocity evaporator coil. Refrigeration system shall include all fittings, valves, switches, controls and all related components to comprise a complete operating unit of sufficient BTU capacity to maintain automatic operation of 35 degree F product temperature in coolers and -10 degree F product temperature in freezers. Refrigeration system provided with outdoor remote air cooled condensing unit shall be provided with winterized controls (low ambient package) including crankcase heater, line dryers and head pressure control unless specified as part of a pre-assembled refrigeration rack system. Refrigeration lines to be run within any slab or floor shall be either hard copper or soft copper if run within conduit.

HH. All electrical wiring, plumbing lines, gas lines (except exposed threaded pipe gas manifolds at cooking appliances), steam lines and refrigeration lines shall be concealed in the floor, walls or above the finished ceiling in an acceptable manner and in compliance with all applicable codes. Where it is impractical to run lines within the floor, walls or above the finished ceiling, lines shall be enclosed in a stainless steel (or alternate “smooth and cleanable” approved material) with appropriate access for service or replacement. In situations of an island arrangement or where equipment is not situated with access to a wall surface, lines must be installed in the floor in an approved manner including in-ground conduit for refrigeration and beverage lines. In no case shall any lines be “exposed”.

II. Furnish materials and install all interconnecting wiring as required for the food service equipment, except for exhaust ventilation and fire suppression systems. This shall include inter-wiring of control panels furnished as a part of a fixture or appliance, on-off switches for light fixtures furnished as a part of a fixture or appliance, inter-wiring of control devices to motors furnished as a part of a fixture or appliance, time clock circuits for freezers from remote condensing unit to evaporator coil, heated pressure relief ports in walk-in freezer, electrical receptacles furnished as a part of a fixture or appliance, light fixtures in exhaust hoods and walk-in refrigeration to on-off switches and conduit junction boxes, ceiling mounted heat lamps to remote wall switch and inter-wiring of food waste disposer from control device to disposer motor as required to complete the installation of the food service equipment.

JJ. Furnish materials and install heat tracing tape to all condensate lines within walk-in freezer; insulate entire heat tracing tape with foam pipe insulation.

KK. Furnish materials and install all interconnecting plumbing as required for the food service equipment, except for exhaust ventilation and fire suppression systems. This shall include faucets, drains, drains with connected overflow, shut-off valves, vacuum breakers, flow or pressure control valves, gauges, bleeder tubes, piping from disposer control devise to disposer cone and disposer body inlets and piping for steam operated equipment from boiler take-off valve at steam generator to steam inlet connection at appliance as required to complete the installation of the food service equipment.

LL. Furnish materials and install insulated copper interconnecting piping between the dishmachine and the hot water booster heater, this shall include the installation of

pressure and temperature gauges, strainer and shock absorber in the hot water supply line to the booster heater.

MM. Furnish materials and install insulated copper interconnecting piping between the dishmachine and the hot water booster heater, this shall include the installation of pressure and temperature gauges, strainer and shock absorber in the hot water supply line to the booster heater.

NN. Furnish and install water filter assemblies, sized and of the proper type to accommodate the water flow rate and “particulate” requirement of the food service equipment; this shall include all combi and bake ovens, steam cookers, proofing cabinets, ice makers, coffee brewing equipment and soda and beverage dispensing equipment.

OO. Furnish and install copper condensate lines in walk-in refrigeration from evaporator coil to waste receptor.

PP. Furnish and install gas supply shut-off valve at each gas manifold connection and furnish and install flexible gas hose connectors to each shut-off valve and to each cooking appliance.

QQ. Furnish materials and install interconnecting chrome plated exposed piping for hose reel and hose bibs including installation of check valves and vacuum breaker in supply line; this shall include chrome plated bleeder outlet if required by local health department regulations or local plumbing codes.

1.3 WORK BY THE ELECTRICAL TRADE

A. Rough-in utility connections including proper voltage, phase and amperage required to satisfactorily operate all items of food service equipment.

B. Final connection of the food service equipment from the rough-in location to the connection point on all food service equipment and necessary connection points.

C. All electrical components for the exhaust and supply ventilation system (including condensate hoods and pant leg vent systems) including, electrical disconnects, starters, exhaust fan on-off switch with indicator lights located in kitchen and supply fan controller with indicator lights located in kitchen and dishroom.

D. Furnishing and installation of all accessories, components and fixtures other than those specified as part of the food service equipment, to include but not be limited to, electrical circuit breakers or fuses, electrical receptacles, disconnect switches, on-off switches or other fittings and appurtenances that are required to connect the food service equipment in accordance with manufacturer’s instructions and result in proper operation.

E. Utility disconnection and termination of discontinued services of existing food service equipment to be terminated.

F. Furnishing and installing electrical plug and cord sets where not furnished as part of the appliance.

G. Electrical contractors or shunt-trip circuit breakers to interrupt electrical power to all electrically operated food service cooking appliances.

H. In-floor, flush mounted, waterproof electrical receptacles of type and capacity to match plug and cord sets for all mobile food service counter equipment.

I. Ceiling mounted, retractable drop cords to accommodate food service equipment in an island arrangement, of the type and capacity to match plug and cord sets of the food service appliances.

J. Furnishing materials and installation of all interconnecting wiring as required for the food service exhaust ventilation and fire suppression systems; this shall include wiring of electrically operated gas supply shut-off valves for fire suppression systems, fire suppression system wiring to building fire alarm, heat detector electrical detection device to automatically start supply and exhaust fans and exhaust hood light fixtures to remote wall switch.

1.4 WORK BY THE PLUMBING TRADE

A. Rough-in utility connections including gas, steam, hot and cold water and floor receptors and drains in proper sizes, pressures and quantities required to satisfactorily operate all items of food service equipment.

B. Final connection of the food service equipment from the rough-in location to the connection point on all food service equipment and necessary outlets.

C. Furnishing and installation of all accessories, components and fixtures other than those specified as part of the food service equipment, to include but not be limited to stop cocks, traps, pipe, shut-off valves, pressure reducing valves or other fittings and appurtenances that are required to connect the food service equipment in accordance with manufacturer’s instructions and result in proper operation.

D. Furnishing and installing chrome plated indirect waste outlet piping for food service equipment, from the waste outlet connection on the food service equipment to the building waste receptacle (floor sink, etc.).

E. Flushing and sanitizing of lines before making final connections to the food service equipment.

F. Grease interceptors for food service equipment in capacity and size as required by code.

G. Furnish and install exposed threaded gas manifold piping for all cooking appliances and welded in-wall gas manifold piping.

H. Install gas shut-off valve supplied as part of the fire suppression system in the gas supply line in an exposed and accessible location.

1.5 WORK BY THE MECHANICAL TRADE

A. Supply and exhaust ventilation for indoor refrigeration condensing units based on 750 cfm for each air cooled compressor horsepower and 250 cfm for each water cooled compressor horsepower.

B. Exhaust ventilation for condensate applications including fully welded 18 gauge stainless steel or 12 gauge aluminum liquid tight ductwork pitched toward source to prevent leaking, fan and start-sop switch with indicator lights located in the dishroom.

C. Exhaust hood exhaust ventilation system including roof top mounted “utility set” type up-blast centrifugal fan with backward incline wheel, adjustable sheaves, vibration mounts and bird screen at discharge end; fan shall be rated at 14 sones or less and shall be UL 710 listed; roof curb, exhaust ductwork constructed of a minimum 16 gauge galvanized steel or 18 gauge stainless steel, fully welded liquid tight with clean-outs at every major bend and in 20 foot intervals; ductwork shall not exceed a three to one aspect ratio, connection to exhaust fan shall include a UL listed and rated vibration eliminator and ductwork shall be insulated with all prevailing codes.

D. Exhaust hood supply ventilation system including roof top mounted UL listed supply fan with vibration mounts, adjustable sheaves, roof curb, bird screen at intake end, maintainable filtration system, and gas or electric heated supply air heater (supply air heater heat incoming supply air below a 65 degree F ambient temperature) and 22 gauge galvanized steel ductwork.

E. Disconnection and termination of discontinued ductwork of existing exhaust or condensate hoods to be terminated or relocated, and modification or preparation of exhaust system for existing exhaust or condensate hoods to be relocated at the new location.

1.6 WORK BY THE CONSTRUCTION TRADE

A. Masonry bases, floor curbs, structural pads, floor depressions, roof curbs, flues and fireproof duct shafts or enclosures.

B. Conduit for beverage lines (PVC if embedded in concrete or smooth aluminum if exposed) with 24" radius sweep bends and 24" x 24" pull boxes every 100 lineal feet or three turns including sleeves any through walls, floors and ceilings.

C. Sleeves and openings through wall, floors and ceilings for passage of refrigeration lines.

D. Wall blocking or reinforcing to adequately support wall mounted food service equipment or fixtures; provide 3/4" thick exterior grade plywood backing for wood stud applications and 16 gauge steel backing for metal stud applications.

E. Stainless steel or FPR wall paneling behind all mop receptors, dishtables and pot / utensil washing sinks.

F. Installation of floor pans in floor depression with floor pans set flush and finished watertight around entire perimeter at juncture with floor surface.

G. Conduit for refrigeration lines (PVC if embedded in concrete or smooth aluminum if exposed) with 24" radius sweep bends including sleeves any through walls, floors and ceiling.

1.7 WORK BY THE ROOFING TRADE

A. Roof penetrations properly sealed and flashed to prevent water penetration.

1.8 BIDDING INSTRUCTIONS AND QUALIFICATION OF BIDDER

A. The primary items of food service equipment described in this specification are considered the basis of the bid. Only “equal” items listed as part of this specification will be considered and must meet the conditions of the base bid item; this shall include all materials and material finishes, fabrication methods, electrical, plumbing, and mechanical components, electrical control devices, hardware, accessories and options, exactly as specified without exception. It will be the full and complete responsibility of the Food Service Equipment Contractor to pay any and all costs incurred in adapting any other “equal” item to the mechanical, electrical, exhaust ventilation or structural systems of the building including any other cost increase incurred as a result of engineering changes to the mechanical, electrical, exhaust ventilation, architectural, structural or food service drawings. The contract is to be awarded as follows:

1. The competence and responsibility of the bidder.
2. An itemized cost breakdown of each scheduled item of food service equipment is required, as specified, in order that the District may, at his option, delete any item or supply any portion thereof, or increase the quantity of any item without affecting the cost quoted for the remaining items. “Pre-approved” substituted items must be submitted as an add or deduct alternate in addition to the base bid.
3. The District is not obligated to accept the lowest or any other bid. The award of the contract and choice of the food service equipment Contractor shall be at the District's discretion.

B. Each bidder shall be responsible to visit the project site of the proposed work and fully acquaint himself with conditions as they exist.

C. Each bidder is responsible to attend any pre-bid meeting as required by the District.

D. Each bidder shall be responsible to examine and review the contract document drawings and specifications. Should the bidder find during examination of the drawings and specifications any discrepancies, omissions, ambiguities, or conflicts in or among the contract documents or shall be in doubt as to their meaning, the District shall be notified no later than four working days prior to bid opening for clarification.

E. The failure or omission by any bidder to receive or examine any form, instrument or document or to visit the project site shall in no way relieve him from obligation with

respect to his bid. No claims for any extras will be allowed due to unintentional errors, conflicts, or omissions in the contract documents drawings or specifications.

1.9 SUBMITTALS

A. Product Data: For each buy-out item of food service equipment indicated. Include manufacturer's model number and accessories and requirements for access and maintenance clearances, water and drainage, power or fuel and service connections including roughing-in dimensions

B. Shop Drawings: For food service equipment not manufactured as standard production and catalog items by manufacturers. Shop drawings shall include the following information:

1. Dimensioned rough-in plans scaled at 1/4"=1'-0" accurately locating connection points and indicating utility data for all mechanical, electrical and supply and exhaust ventilation requirements.
2. Dimensioned plans scaled at ½"=1'-0" accurately locating and indicating the finished size of masonry bases, floor depressions in structural slabs, stub walls, curbs and finished openings for pass-thru equipment.
3. Dimensioned plans scaled at 1/4"=1'-0" accurately locating conduit and pull boxes for beverage and refrigeration lines including floor, wall and ceiling penetrations and termination points.
4. Dimensioned plans and detailed drawings of all custom fabricated food service equipment scaled at 3/4"-1'-0" for plan and elevation views and 1-½"=1'-0" for sectional views.

C. Copies of original maintenance and repair manuals including a list of all authorized service agencies responsible for each item of food service equipment.

1.10 QUALITY ASSURANCE

A. Manufacturer's qualifications shall include a firm that has regularly engaged in the manufacturing of food service equipment of the same type, capacity, performance and size as specified and whose products have been in similar service for not less than five years.

B. Custom fabricator qualifications for custom food service equipment shall include a skilled sheet metal shop with a minimum of five years' experience in custom sheet metal food service equipment fabrication of similar type as specified. All custom food service equipment shall be fabricated at the same shop.

C. Installer's qualifications shall include a firm with at least three years of successful installation experience on projects with a similar scope to that as required for this project.

D. Food service equipment dealers' qualifications shall include a firm which is regularly engaged in the purchasing of food service equipment as is a manufacturer authorized agent of the specified equipment for not less than five years. The dealer shall also

employ a full time project management staff to oversee the purchase of the equipment in compliance with the specifications, coordinate the form and fit of the equipment to the project site conditions, attend all project meetings, coordinate shop drawing review, coordinate installation with the Trades, coordinate factory training and address all issues as they relate to the satisfactory completion of the facility in compliance with the specifications and related documentation.

E. Codes and Standards: All food service equipment furnished and installed under this specification shall be manufactured in strict compliance with the following publications or the current or revised related publication as well as all state, national and local codes and agencies having jurisdiction over same:

1. National Electrical Manufacturer Association NEMA
    a. ICS-77 Industrial Controls and Systems
2. National Electrical Manufacturer Association NEMA
    a. ICS-77 Industrial Controls and Systems
    b. 17.4 Local Application System
    c. 17.13 Water Sprinkler Systems
    d. 96-76 Installation of Equipment for the Removal of Smoke and Grease Laden Vapors for Commercial Cooking Equipment
3. National Sanitation Foundation NSF
    a. 11 76 Food Service Equipment
    b. 4 73 Commercial Cooking and Warming Equipment
    c. C-2-72 Special Equipment and/or Devices
4. National Electrical Manufacturer Association NEMA
    a. 57-78 Electric Lighting Fixtures
    b. 197-78 Commercial Electric Cooking Appliances
    c. 300 Fire Extinguishing Systems

F. All food service equipment shall be manufactured in strict compliance with standards as set forth by the National Sanitation Foundation (NSF) including fabrication of custom built equipment and shall be listed with same and shall bear their seal. Any item of food service equipment lacking the NSF seal will be rejected.

G. All electrically operated food service equipment shall be constructed in strict compliance with standards as set forth by the Underwriters Laboratories (UL) and shall utilize approved components and assemblies and shall bear the label thereof.

H. Custom fabricated food service equipment shall be constructed to the standards as set forth by the National Association of Food Equipment Manufacturers (NAFEM).

I. All refrigeration equipment and all pressurized vessels shall be constructed, approved, inspected, registered and stamped and installed in strict compliance with the American Society of Mechanical Engineers (ASME), state and local codes for Unfired Pressure Vessels and all other agencies having jurisdiction thereof.

J. All gas operated food service equipment shall be fabricated in strict compliance with standards as set forth by the Underwriter Laboratory (UL) and shall be listed with same and shall bear their seal.

K. Steam operated equipment shall be fabricated and installed in accordance with Pennsylvania Department of Labor and Industry standards.

L. Product Options: Drawings indicate food service equipment based on the specific products indicated. Other manufacturers' equipment with equivalent size and performance characteristics may be considered.

M. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Review methods and procedures related to food service equipment including, but not limited to the following:

1. Review access requirements for equipment delivery.
2. Review equipment storage and security requirements.
3. Inspect and discuss condition of substrate and other preparatory work performed by other Trades.
4. Review structural loading limitations.
5. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.

1.11 DELIVERY, STORAGE AND HANDLING

A. Deliver food service equipment as factory-assembled units with protective crating and covering.

B. Store food service equipment in original protective crating and covering and in a dry location.

1.12 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before equipment fabrication and indicate measurements on Shop Drawings and Coordination Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.13 COORDINATION

A. Coordinate equipment layout and installation with other work including light fixtures, HVAC equipment and fire-suppression system components.

B. Coordinate location and requirements of service-utility connections.

C. Coordinate size, location and requirements of concrete bases, positive slopes to drains, floor depressions and insulated floors. Concrete, reinforcement and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete".

D. Coordinate installation of roof curbs, equipment supports and roof penetrations, as specified in Division 7 Section “Roof Accessories”.

1.14 WARRANTIES

A. General Warranty: The special warranty specified in this Article shall not deprive the District of other rights the District 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. All buy-out food service equipment herein specified shall have all parts and labor warranted in writing, from the date of Final Acceptance by the District against defective parts, materials, workmanship and design for a period of time as stated within the manufacturers standard published warranty, but no less than two years.

C. All custom fabricated food service equipment shall be warranted as stated above except for a period of two years.

D. Refrigeration equipment shall include start-up and two year parts and labor warranty on the entire refrigeration system and manufacturers five year parts warranty on hermetic scroll and semi-hermetic sealed compressors.

E. Existing equipment refurbished for reuse shall be warranted in writing, against defective parts, materials and labor as stated above but for a period of 90 days.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

A. Stainless steel shall be type 304 extra low carbon non-magnetic austenitic 18% chrome, 8% nickel alloy steel. Gauges shall be U.S. Standard of Thickness set forth below:

GAUGE	**THICKNESS**	**GAUGE**	**THICKNESS**
10	.1346	16	.0598
11	.1196	18	.0478
12	.1046	20	.0359
14	.0747	22	.0299

B. All sheets shall be of maximum length to permit fabrication from one sheet. All thickness must meet the above gauge thickness within tolerances set forth by the ANSI after polishing. Finished sheets exceeding these tolerances shall be rejected as not meeting this Specification.

C. Galvanealled steel shall be ARMCO steel or an approved grade of copper bearing steel shall be properly primed, degreased and finished with two coats of synthetic aluminum bronze.

D. Structural steel members used for framing, consisting of angles, bands, bars and channels shall be ductile in quality, free of hard spots, runs, checks, cracks and other surface defects and shall be smooth galvanized by the hot dip process with all surplus removed, free of runs, blisters, excess splatter and uncoated spots or patches.

E. White metal shall consist of corrosion resistant metal containing not less than 21% nickel. All castings shall be rough ground, polished and buffed to a bright luster and shall be free from pit marks, runs, checks, burrs and other imperfections.

F. Stainless steel pipe and tubing shall be seamless or welded of gauge specified and of true roundness. Seamless tubing shall be thoroughly and correctly annealed and ground smooth. Welded tubing shall be thoroughly heat treated and properly quenched to eliminate carbide precipitation, drawn true to size and roundness and polished to match stainless steel sheets.

G. Welding shall be of the electric submerged or concealed arc type, heliarc wherever practical. Where welding rods are required they shall be of the same composition as materials to be joined coated with a non-carbonaceous flux.

H. Plastic Laminate: Complying with NEMA LD 3 and NSF 35 requirements; NSF certified for end-use application indicated; 0.050 inch (1.27 mm) thick, smooth texture and easily cleanable.

1. Color: As selected by Architect from manufacturer’s full range of colors.

I. Plywood and Lumber: Close grain exterior grade mahogany or birch plywood.

J. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Provide elastomeric sealant NSF certified for end-use application indicated. Provide sealant that when cured and washed meets requirements of Food and Drug Administration’s 21 CFR, Section 177.2600 for use in areas that come in contact with food.

1. Color: As selected by Architect from manufacturer’s full range of colors.
2. Backer Rod: Closed-cell polyethylene in diameter larger than joint width.

K. Plastic: Except for plastic laminate, provide plastic materials and components complying with NSF 51.

L. Sound Dampening: NSF-certified, non-absorbent, hard drying, sound-deadening coating. Provide coating compounded for permanent adhesion to metal in 1/8-inch (3-mm) thickness that does not chip, flake or blister.

M. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene or PVC that is nontoxic, stable, odorless, nonabsorbent and unaffected by exposure to foods and cleaning compounds.

2.2 ACCESSORIES

A. Cabinet Hardware: Provide NSF-certified stainless steel hardware for equipment items as indicated.

B. Casters: NSF-certified standard-duty stainless-steel swivel stem casters with 5-inch (125-mm) diameter wheels, polyurethane tires with 1-inch (25-mm) tread width and 300-lb (90-kg) load capacity per caster. Provide brakes on 2 casters per unit.

2.3 FABRICATION, GENERAL

A. All welds shall be strong and ductile, nonporous, free of pits and cracks. Parts which are to be welded shall be homogeneous, of a like color and finish to adjoining material. Excess metal and carbide precipitation shall be ground off, finished smooth and polished. Unexposed welds shall be pacified to prevent attrition. Brazed or soldered joints are unacceptable. Where galvanizing has been damaged due to the welding or grinding process, these areas shall be galvawelded to replace finish

B. All exposed surfaces of the food service equipment shall be free from bolts, screws and rivet fastenings. Wherever bolts are required they shall be of similar composition and finish as the metal to which they are applied.

C. Wherever practical all food service equipment and fixtures shall be factory or shop fabricated of one-piece construction, shipped to the project site as one unit completely assembled.

D. Items of food service equipment or fixtures too large to enter or transverse the building to the installation location in one assembly shall be constructed in sections and shall be furnished with field joints. Where field joints are necessary, all adjoining exposed surfaces shall be field welded at the project site as specified above for welding. Where conditions make welded field joints impractical, each sub-assembly shall be fabricated with off-set draw angles welded to the underside of each adjoining top surface and drawn together to a “hairline” seam with 1/4"-20 stainless steel bolts with lock washers and chrome plated acorn nuts. Bolted field joints will be permitted only where specifically shown on Drawings or specified for a particular item.

E. Wherever shear edges occur they shall be free of burrs, fins or irregular projections and shall be finished to prevent cutting or laceration when the hand is drawn over such shear edges. Brake bends shall be free of undue and where such bends do mar the uniform surface appearance of the material, such marks shall be removed by suitable grinding, polishing and finishing. In no case where miters or bullnose corners occur is overlapping materials acceptable.

2.4 GENERAL FRABRICATION STANDARDS

A. TOPS:

1. Tops shall be fabricated of 14 gauge stainless steel unless otherwise specified. All edges shall be bullnose or formed as specified with all joints butt-edged and electrically welded, ground smooth and polished so no evidence of welding will appear. Soldered corners to achieve round corner construction will not be accepted.
2. Tops adjacent to walls, columns or other equipment shall be turned up integrally into a backsplash as specified. All interior corners shall be coved on a ¾" radius, both horizontally and vertically, forming spherical corners. Ends of backsplashes shall be fully enclosed to the low point of the top edge, fully welded, ground smooth and polished.

B. SUPPORT FRAMING

1. Around the entire perimeter on the underside of all tops and set back 1" from the down-turned edge shall be a fully welded frame assembly fabricated of 1-1/2" x 1-1/2" x 1/8" stainless steel angle iron or material as specified. Provide intermediate cross bracing fabricated of the same material as the angle framing and fully weld to perimeter frame on centers not to exceed 24". Tack weld the entire frame assembly to the underside of the top surface.
2. Open base tables shall be provided with leg mounting channels for weld anchoring leg gussets and shall be fabricated of 1" x 4" x 1" 12 gauge stainless steel or material as specified fully welded at each end of frame and at intervals not to exceed 6'-0".
3. Cabinet base tables and counters shall be provided with triangular corner gusset plates for weld anchoring counter type legs and shall be fabricated of 12 gauge stainless steel fully welded at each corner of table or counter body and at intervals not to exceed 6'-0".
4. Freestanding sinks and Bain Maries shall be provided with triangular corner gusset plates for weld anchoring leg gussets and shall be fabricated of 12 gauge stainless steel, fully welded at each corner of sink or Bain Marie bottom and at intervals not to exceed 6'-0".

C. LEGS AND ADJUSTABLE BULLET FEET

1. Legs shall be constructed of 1-5/8" diameter 16 gauge stainless steel tubing. Each leg shall be swaged and tapered at the bottom. Fasten each leg to a 3-1/2" high conical shaped die-formed stainless steel gusset equivalent to Component Hardware A20-0206. Provide each leg with stainless steel adjustable foot insert equivalent to Component Hardware A10-0852.
2. Cabinet base tables and counters shall be provided with 6" high conical shaped die-formed stainless steel equipment leg with stainless steel adjustable round foot insert equivalent to Component Hardware A72-0811.

D. CROSSRAILS

1. Provide all open base tables and freestanding sinks and bain Maries with 1-1/4" diameter 16 gauge stainless steel tubular cross railing running between legs at a point 10" above the finished floor. Cross railing shall be continuously welded to legs, filleted, ground smooth and polished to provide a smooth coved radius with leg surface.

2. Where cross railing abuts cabinet base fixtures, cross railing shall be concealed bolt anchored to same utilizing stainless steel hardware.

E. UNDERSHELVES

1. Provide solid fixed undershelf, constructed of 16 gauge stainless steel. Front edge shall be turned down 1" at 90 degrees and returned ½" at 45 degrees. Rear and ends shall be turned up 2" high on a 90 degree angle, interior corners coved on ¾" radius.

F. DRAWERS

1. Provide drawer pan constructed of 14 gauge stainless steel with inside corners coved on a 3/4" radius. Drawer front face shall be double pan type constructed of 16 gauge stainless steel with inner pan set into outer pan and welded in place. Drawer front shall be set into and shall be removable from a 14 gauge stainless steel, channel shaped drawer cradle. Drawer suspension slides shall be secured to drawer frame assembly and shall be Component Hardware S52 series full extension type with 14 gauge stainless steel slides with stainless steel ball bearing wheels having a load capacity of 200 pounds. Provide hard rubber bumper drawer stops. Drawer suspension guides shall be fastened to 18 gauge stainless steel housing which is suspended from the angle framing under the table top. Provide drawer fronts with full grip recessed stainless steel flush pull handles.
2. Stainless steel drawer enclosure cabinet with quantity of drawers as specified with cabinet body fabricated of 18 gauge stainless steel, wrap around construction. The backs of front stiles shall be closed with tight fitting channel sections of 18 gauge stainless steel, welded in place, and closed on top and bottom. Drawer suspension slides shall be secured to drawer frame assembly and shall be Component Hardware S52 series full extension type with 14 gauge stainless steel slides with stainless steel ball bearing wheels having a load capacity of 200 pounds. Provide hard rubber bumper drawer stops. Provide drawer fronts with full grip recessed stainless steel flush pull handles.

G. CABINET BASES

1. Cabinet body shall be fabricated of 18 gauge stainless steel wrap around construction. The backs of front stiles shall be closed with tight fitting channel sections of 18 gauge stainless steel, welded in place and closed on top and bottom.
2. Cabinet base shelves shall be fixed bottom and intermediate fabricated of 18 gauge stainless steel. Front edge shall be turned down 1 1/2" at 90 degrees, returned 1/2" at 90 degrees. Rear and ends shall be turned up 2" at 90 degrees with interior corners coved on a ¾" radius. Shelf shall be weld anchored to cabinet body. Bottom shelf shall be fabricated flush with front mullions with fully welded facing junctures presenting seamless construction. Fixed intermediate shelves shall be designed similar to bottom shelf except front edge shall be set behind vertical mullions and fully welded thereto.

H. SLIDING DOORS

1. Sliding doors shall be double pan type constructed of 16 gauge stainless steel with inner pan set into outer pan and welded in place. Doors shall have welded internally 1" x 4" x 1" 14 gauge stainless steel hat type reinforcing channels. Doors shall be fitted with full grip, recessed type stainless steel flush pull handles. Provide 16 gauge stainless steel angle door stops welded to door. Provide hard rubber door stops. Provide each door with two, 1 3/8" diameter stainless steel ball bearing sheaves fastened to 1" x 1/8" thick stainless steel bar stock hangers welded to top corners of each door for suspending on overhead door channel track. Provide hangers with stainless steel removable locks to prevent doors from jumping track during operation while permitting ease of removal. Fabricate overhead track of 14 gauge stainless steel and weld to cabinet body. Provide bottom of doors with nylon door guides secured to bottom shelf. Guides shall not interfere with door removal.

I. HINGED DOORS

1. Hinged doors shall be double pan type constructed of 16 gauge stainless steel with inner pan set into outer pan and welded in place. Hinges shall be stainless steel cam action pin type fastened by means of counter sunk flat head stainless steel screws staggered on centers and tapped into 1/4" thick stainless steel bar stock welded behind door jamb. Doors shall be removable from hinges without the use of tools. Doors shall be held closed by permanent magnet closure devices. Doors shall be fitted with a full grip recessed type stainless steel flush pull handles. Provide hard rubber door stop bumpers.

J. SINKS

1. Sinks shall be fabricated of 14 gauge stainless steel with all interior corners coved on a ¾” radius both horizontally and vertically forming spherical corners.
2. Exposed edges of sink shall be finished with a 1 ½" diameter 180 degree rolled edge, rear and sides adjacent to adjoining surfaces shall have a backsplash turned up 10" high at a 90 degree angle on a ¾” radius and turned back 2 ½" on a 45 degree angle, then down ½" at 90 degrees along back.
3. Multiple sink compartments shall be divided with double wall 14 gauge stainless steel partitions 1" wide rounded on top and all corners at a ¾” radius. Finish bottom, back and front with 14 gauge stainless steel to form one continuous sink with no overlapping joints or open spaces between sink compartments.
4. Integral drainboards shall be constructed of 14 gauge stainless steel. The front portion shall continue the 1 ½" diameter 180 degree rolled rim of the sink bowl on a continuous level horizontal plane. The surface of the drainboard shall be pitched from 2 ½" at the end away from the sink to 3" at the sink bowl. Sink and drainboard backsplash shall be continuous and level on the horizontal plane. All interior corners both vertical and horizontal shall be coved on a ¾” radius. Drainboards shall be reinforced with 1" x 4" x 1", 12 gauge stainless steel “hat” channels extending front to rear tack welded to underside of drainboard for weld anchoring leg gussets.
5. Provide crossrails extending front to rear between legs, crossrails shall not extend along rear at sink to prevent interference with plumbing.
6. Built-in sink compartments shall be fabricated as an integral part of fixture with sink fully welded with adjacent top, weld ground smooth and polished.

K. MILLWORK

1. Millwork fabricator shop shall be a certified participant in AWI's Quality Certification Program (QCP) to standard "Premium" construction.
2. Tops shall be fabricated of 3/4" thick 5-7 ply BW marine grade plywood build up to a 1 ½" thickness. All plastic laminate finished edges shall be applied prior to the surface laminate. Provide cross bracing around entire perimeter below tops and above all interior dividers to minimize deflection from equipment. Tops shall be fabricated in sections as large as possible to minimize field seams. Field seams shall be assembled utilizing TB-2 yellow glue. The bottom surfaces of all tops must be sealed with gray cabinet liner to comply with Board of Health requirements. Cut-outs for drop-in equipment shall be cut in the shop and with all edges sealed. All drop-in equipment shall be pre-fitted in top prior to delivery to the job site. All drop-in equipment shall be sealed with General Electric or equivalent clear silicon sealer after installation. Hardwood edges shall be applied prior to surface laminate. All hardwood to match for color and grain. Edges to be chamfered and finished as specified. Solid surface tops shall receive full plywood substrate with 3/4" x 3" batons for proper air space. All tops shall be prepared for installation of sneeze guards including additional blocking and / or cutouts.
3. All cabinet base and interiors shall be fabricated of 3/4" thick 5-7 ply marine grade plywood with high-pressure laminate finish. Recessed toe base shall be 6" high fabricated of 3/4" thick 5-7 ply marine grade plywood with 16 gauge stainless steel finish. Shelf pilasters to be recessed type 250WH with 253WH locking clips. Cabinet backs shall be fabricated of 1/4" thick MELA-MDF board. Cabinet ends to be dadoed for back and bottom and notched to receive aprons and kicks. Butt or dowel construction will not be acceptable. Cabinets shall be assembled with TB-2 yellow glue with screws and staples. Cabinets with finished backs shall be fabricated of 3/4" thick 5-7 marine grade plywood with high-pressure laminate finish. Cabinets over 48" in length shall have interior dividers. Dividers shall be dadoed into the bottom and notched for aprons. Dividers shall be notched as required for equipment. Aprons shall be large enough to conceal drop-in equipment and also to house control panels. Cabinet bases shall be fabricated in sections as large as possible to minimize field seams.
4. Doors shall be fabricated of 3/4" thick MDF board with high-pressure laminate finish and shall be furnished with three BLUM 75M5580 or 75M5680 European style concealed hinges. Door pulls shall be Hafele 116.39.437. Locks where required shall be cam style, keyed alike. Doors shall not exceed 27" in width and shall be of equal size.
5. Drawers shall be constructed of 3/8" thick birchwood with dove tail joinery. Drawer slides shall be Accuride 150 lb. full extension type with stainless steel ball bearing hardware.
6. Applied wood fascia panels and doors shall be stile and rail design. Panels to be recessed or raised as specified. All wood to be select for color and grain. Finish shall match stock color samples or custom to match furnished sample. All panels and doors to be equally sized per cabinet. Provide full wood louvered panels as required for equipment requiring air circulation. Finish all wood with stain followed by single coat of sealer. After sealer, apply one layer of Armourcote conversion varnish approved for use in food service with 55% gloss.

L. SOLID AND HARD SURFACE MATERIAL ("CORIAN" / "ZODIAK")

1. Provide counter top, tray slide, etc. of approved solid surface material. Material shall be fabricated and assembled per manufacturers approved methods utilizing a factory authorized and certified fabricator and installer. The edges of the top shall be formed as indicated on the food service and architectural detail drawings, routed and finished as directed. Openings shall have radius corners and shall be reinforced with additional material. Where drop-in appliances are to set on tops, the fixture shall be furnished with a ¾" thick marine grade plywood sub-top fabricated with a perimeter frame extending through the opening in the top preventing the appliance from setting directly on the solid surface material and allowing the sub-top to distribute the weight of the appliance. Where heated appliances are to set on the top the sub-top is to be fabricated as above to prevent heat from being in direct contact with the solid surface top; additional fiberboard insulation material is to be provided where transfer of radiated heat will contact any solid surface material

M. PAINTING

1. Galvanized steel shall be cleaned and degreased with mineral spirits, primed with a minimum of two coats of primer and spray finished with a minimum of two coats of gray epoxy enamel paint

N. LAMINATED PLASTIC

1. All exposed surfaces shall be faced with 1/16" thick high pressure plastic laminate in color and pattern as specified.
2. All unexposed surfaces shall be faced with .020 or .030 gray thermoset decorative overlay.
3. Where the plastic laminate is to be bonded to removable or fixed panels the panels shall be fabricated of 3/4" thick close grain marine grade mahogany or birch plywood with surfaces bonded with waterproof glue.
4. Where the plastic laminate is to be bonded directly to the metal facing of a cabinet base table or counter, surfaces shall be bonded with contact adhesive.

O. CLOSURE TRIM

1. Provide closure trim pieces fabricated of 16 gauge stainless steel or of material and finish as specified, trim shall be one piece constructions furnished to seal both horizontal and vertical junctures and openings

2.5 STAINLESS STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal products" for recommendations relative to applying and designating finishes.

1. Remove or blend tool and die marks and stretch lines into finish.
2. Grind and polish surfaces to produce uniform directional textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Concealed Surfaces: Minimum of 80 grit finish.

C. Exposed Surfaces: No. 4 finish (bright, directional polish) of 180 grit.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

E. Protect mechanical finishes on exposed surfaces from damage by applying a strippable temporary protective covering before shipment.

2.6 STANDARDS FOR EXISTING EQUIPMENT

A. The food service equipment contractor shall examine each item of food service equipment specified as existing to be reused prior to his submission of his bid to ascertain proper fit and alignment in its proposed location, inspect for any physical damage and to determine the present operational performance and condition of each item or any component thereof and submit to the Owner as part of his bid the extent of repairs or replacement parts, required to recondition the entire unit for satisfactory operation.

B. The food service equipment contractor shall disassemble each existing item to be reused, clean, service and recondition including any transport for reconditioning if required at any service agency or shop, redeliver or relocate at the project site to the new location, set-in-place, align and secure in its new location and assemble any fixtures, components and sub-assemblies, left ready for final utility connections by the Trades.

1. Cleaning of the food service equipment shall include a thorough scrapping and steam cleaning to remove scale and all foreign material.
2. Repainting of all fabricated and buy-out items having worn or scarred exposed surfaces that are not stainless steel materials. Repainting shall be a minimum of two coats of original paint or touched-up as required.
3. Repair any damage incurred during relocation or transit such as dents, cracks or broken welds.
4. Replacement of door gaskets and seals and realignment for proper operation.
5. Replace non-functioning condensate evaporators in refrigerators.
6. Replacement of broken door hinges, drawer slide assemblies, door and drawer handles, door pans or lock assemblies.
7. Servicing and cleaning of all condensing units, (vacuum and comb), evaporator coils, expansion valves, etc. setting and adjusting of all temperature controls to maintain normal operating temperature and charging of the refrigeration system with proper refrigerant. Refrigeration systems to be re-used shall be recharged with proper refrigerant or converted to an acceptable code compliant refrigerant.
8. Replace or repair all plumbing components as required including faucets and waste outlets with fixtures of similar type and manufacturer.
9. Pump-down of all refrigeration systems to be discontinued or relocated and re-claiming and disposal of all refrigerant and toxic materials as necessary.

C. The following work shall be included as part of this contract on specified items or as required by the Owner or as determined or recommended as necessary during the site inspection.

1. Repair or replacement of all materials or parts to correct any gas, steam or electrically operated cooking appliance including power generation devices such as boilers and related mechanical and electrical heating and control components and devices.
2. Remove, sharpen and reinstall all cutting blades on all cutting machinery including slicers, food cutters and food choppers.
3. Recondition and lubricate electric motors and transmission devices, replacing worn or damaged gears, drive belts, etc. and repacking or replacing oil with proper type as recommended by the manufacturer.
4. Inspecting, cleaning and upgrading of exhaust ventilation systems including fire protection systems and components. Exhaust hood shall be steam cleaned and chemically treated to remove all traces of grease and foreign material, painted exhaust hoods shall be primed and repainted with a minimum of two coats of primer and fire resistant paint, filters shall be replaced with grease extractor type filters to match design air volume requirements and fusible links shall be replaced with proper heat values. Fire system shall be inspected and recharged to full operational condition. Fire system nozzles and related piping and fittings shall be relocated and reworked to accommodate the new equipment arrangement with nozzle heads replaced as required. All ductwork shall be inspected to assure compliance with present codes and statutes with all ductwork thoroughly cleaned. Air movement shall be measured for proper air quantities and velocities and conditions corrected to meet proper requirements. All conditions of the existing exhaust ventilation and fire protection system shall be in compliance with all current prevailing codes, statutes and NFPA requirements.

D. All nameplates are to be left completely legible.

E. Existing equipment to be reused shall have all utilities disconnected, terminated, or capped-off by the Plumbing, Electrical and Mechanical (HVAC) Trades.

F. Plumbing, Electrical and Mechanical (HVAC) Trades shall provide all mechanical, electrical and HVAC services as required and provide final connection to same at the new site location.

G. Final determination and verification of Plumbing, Electrical and Mechanical (HVAC) requirements for all existing food service equipment to be reused is the responsibility of the Mechanical and Electrical Engineer. Provisions for relocated utility requirements shall conform to current codes and statutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions with Installer for compliance with requirements for installation tolerances, service-utility connections and other conditions affecting

installation and performance of food service equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine roughing-in for piping, mechanical and electrical systems to verify actual locations of connections before installation

3.2 INSTALLATION

A. Set each item of fixed food service equipment securely in place, level and adjust to correct height. Anchor to supporting surface where required for sustained operation and use without shifting or dislocation. Provide concealed anchoring where possible. Adjust work surfaces to a level tolerance of 1/16" maximum offset and slope drainage surfaces at 1/16" per foot.

B. Complete field assembly of field joints by welding or bolting utilizing the method as indicated with the fixture. Grind all field welds smooth and polish. Set and trim all gaskets to be installed as part of field assembly.

C. Treat enclosed spaces that are inaccessible after food service equipment installation by covering all horizontal surfaces with powdered borax at a rate of 4 ounces per square foot.

D. Provide closure trim pieces fabricated of 16 gauge stainless steel or of material and finish as specified, trim shall be one piece construction furnished to seal both horizontal and vertical junctures and openings where the conditions given below occur:

1. Food service equipment is installed into wall openings. Trim shall apply to both sides of wall opening with all corners fully welded, ground smooth and polished.
2. Two or more items of food service equipment are butted together.
3. Food service equipment is installed against wall, columns other equipment resulting in a gap or juncture exceeding 1/4" in width.
4. An open gap of any size between the juncture or joint between adjoining items of food service equipment, wall or column surfaces which might result in the penetration or collection of grease or vermin.

E. Provide cut-outs and openings in food service equipment as required to extend plumbing, electric, steam or gas lines through the food service equipment either for interconnection of utility lines or final connection.

F. Seal around each item of food service equipment with sealant for gaps or spaces less than 1/4" in width and with stainless steel trim for gaps or spaces exceeding 1/4" in width. Closure strips shall conform to the shape and size of the surfaces or juncture to be sealed and shall be neatly scribed for a tight fit.

3.3 PROTECTION AND CLEANING

A. Provide final protection and maintain conditions in a manner acceptable to District, Manufacturer and Installer that ensure food service equipment is without damage or deterioration at the time of Substantial Completion.

B. After completion of the food service equipment installation and completion of other major work in the food service area remove protective coverings and clean and sanitize all food service equipment both internally and externally. Restore exposed and semi-exposed finished to remove abrasions or other surface damage, polish exposed metal surfaces and touch-up painted surfaces. Replace work which cannot be successfully restored.

3.4 COMMISIONING

A. Delay start-up of the food service equipment until utility services have been installed, completed and tested, balanced and adjusted for pressure and voltage, and until water and steam lines have been treated and cleaned for sanitation. Before start-up of the food service equipment lubricate in accordance with manufacturer's instructions.

1. Coordinate food service equipment startup with service-utility testing, balancing and adjustments. Do not operate steam lines before they have been cleaned and sanitized.

B. Provide on-site demonstration and formal technical training by the manufacturer's technical representative for each item of food service equipment as required to instruct the District and its personnel in the safe operation and sanitation and maintenance of the food service equipment.

C. Test each item of food service equipment for proper operation.

1. Repair or replace equipment that is defective in operation including units that operate below required capacity or that operate with excessive noise or vibration.
2. Test refrigeration equipment's ability to maintain specified operating temperature under heavy-use conditions. Repair or replace equipment that does not maintain specified operating temperature.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Test motors and rotating equipment for proper rotation and lubricate moving parts according to manufacturer's written instructions.
5. Test water, drain, gas, steam, oil, refrigerant and liquid-carrying components for leaks. Repair or replace leaking components.
6. Train District's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventive maintenance for each food service equipment item.
7. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout".
8. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data".

9. Schedule training with District through Construction Manager with at least seven days advance notice.

3.5 SCHEDULE OF EQUIPMENT

A. Equipment Schedule: Refer to all Contract Documents pertaining to the food service areas. Equipment itemized along with brands and model numbers and salient features establish the standard for construction, operation and engineering criteria.

B. Equipment indicated below is intended to establish the standard of quality of the food service equipment. Alternate “Equal” products by other manufacturers may be considered if equivalent in design, performance, durability and function.

C. This document is the intellectual property of Corsi Associates and as such use by any other entity is prohibited.

ITEM #01	WALK-IN COOLER
Quantity:	One (1)
Manufacturer:	Norbec / Bally / Amerikooler
Model:	Size and shape as per plan
Construction:	Furnish and erect, compartment, sectional, urethane insulated walk-in cooler assembly.

Walk-in assembly shall bear the UL label and NSF and Factory Mutual seals and shall meet 2015 Federal Regulations.

Ceiling and wall panels shall be constructed of 4" thick urethane insulation, assembly to be accomplished by the use of integral cam type locking device, secured in place during the foaming process. Seams between panels shall be insulated with vinyl foamed in place gasket material.

Ceiling and wall panels shall be finished of 18 gauge embossed aluminum on interior and exterior surfaces.

Walk-in assembly shall be provided with 1/8” thick aluminum diamond tread plate floor insulated with 4" thick urethane insulation and provided with NSF approved coved corners. Floor installation shall be in accordance with manufacturers recommended practice and shall sit in building floor depression with adjacent kitchen floor material finish in walk-in, set flush with kitchen floor.

Construction Trade shall furnish and install floor depression and finished floor within walk-in assembly. Pitch floor within walk-in towards entrance door at 1/8" per foot minimum.

Walk-in assembly shall be furnished with in-fitting type door and frame assemblies constructed of 16 gauge stainless steel provided with three self-closing cam action chrome plated hinge assemblies, handles and hardware.

Provide each door with 2" dial type flush mount thermometer with chrome plated bezel mounted in door frame.

Provide each door with triple pane observation and 36” high 3/16" thick aluminum diamond tread kick plate on both interior and exterior side.

Provide each door with UL listed, vapor proof LED light fixture complete with toggle switch and pilot light and full perimeter frame condensation heater.

Provide four (4) U.L. listed, vapor proof LED ceiling mounted light fixtures complete with stainless steel mounting hardware (two in each compartment).

Foodservice Equipment Contractor shall install ceiling mounted light fixtures and furnish materials and inter-wire light fixtures and switch.

Furnish and install 18 gauge embossed aluminum vertical trim angles and ceiling closure panels.

Furnish and install entire refrigeration system complete with Copeland semihermetic condensing units and insulated copper refrigeration lines charged with R404A refrigerant. Each condensing unit shall be interconnected to a low profile, high velocity evaporator coil in each walk-in compartment. Refrigeration system shall include all fittings, valves, switches, controls and all related components to comprise a complete operating unit of sufficient BTU capacity to maintain automatic operation of 35 degree F product temperature in cooler.

Refrigeration system shall be provided with outdoor remote air cooled condensing units with each condensing unit to be located on the building roof.

Condensing units shall be provided with winterized controls (low ambient package), including crankcase heater, line dryer, head pressure control and galvanized steel stand with stainless steel weather hood.

Provide all hangers and brackets as required to install refrigeration lines.

Construction Trade shall furnish all sleeves and openings through walls, ceiling and floor for passage of refrigeration lines. Furnish galvanized steel stand.

Mechanical (HVAC) Trade shall provide exhaust ventilation for indoor condensing units based on 750 CFM exhaust for each compressor horsepower for air cooled condensing units.

Foodservice Equipment Contractor shall furnish and install copper tubing and extend evaporator coil condensate line to floor receptacle.

Set and adjust all temperature and defrost cycles.

Pump down switch on outside of walk-in to shut unit down.

Provide start-up and two year material and labor warranty on entire

refrigeration system, and five years manufacturer's warranty on compressor.

Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM #02 EVAPORATOR, WALK-IN COOLER
Quantity: One (1)
Manufacturer: Norbec / Bally / Amerikooler
Model: Custom
Remarks: Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

Provide low profile center mounted evaporator.

ITEM #03 CONDENSING UNIT, WALK-IN COOLER
Quantity: One (1)
Manufacturer: Norbec / Bally / Amerikooler
Model: Custom
Remarks: Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM #04 EVAPORATOR, WALK-IN FREEZER
Quantity: One (1)
Manufacturer: Norbec / Bally / Amerikooler
Model: Custom
Remarks: Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM #05 CONDENSING UNIT, WALK-IN FREEZER
Quantity: One (1)
Manufacturer: Norbec / Bally / Amerikooler
Model: Custom
Remarks: Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM #06 SHELVING UNIT, ALL PLASTIC, U-SHAPED ASSEMBLY
Quantity: One (1)
Manufacturer: Quantum / Metro / Eagle Group
Model: QP243674VS-5
QP246074VS-5 (2)
Options: Remove front posts from 36" shelving unit
QP-S-HOOKL (2)
Remarks: Assemble into five tier unit(s) with bottom shelf 12" above finished floor.

Shelving units to be assembled into U-shape as shown on plan. Posts shall be re moved along interior corner and hooks shall be attached where shelving units meet.

ITEM #07 SHELVING UNIT, ALL PLASTIC, U-SHAPED ASSEMBLY
Quantity: One (1)

Manufacturer: Quantum / Metro / Eagle Group
Model: QP243674VS-5
QP244874VS-5 (2)
Options: Remove front posts from 36” shelving unit
QP-S-HOOKL (2)
Remarks: Assemble into five tier unit(s) with bottom shelf 12” above finished floor.

Shelving units to be assembled into U-shape as shown on plan. Posts shall be re moved along interior corner and hooks shall be attached where shelving units meet.

ITEM #08 SHELVING UNIT, ALL PLASTIC
Quantity: One (1)
Manufacturer: Quantum / Metro / Eagle Group
Model: QP246074VS-5
Remarks: Assemble into five tier unit(s) with bottom shelf 12” above finished floor.

ITEM #09 SHELVING UNIT, ALL PLASTIC, L-SHAPED ASSEMBLY
Quantity: Two (2)
Manufacturer: Quantum / Metro / Eagle Group
Model: QP246062VS-4
QP244862VS-4
Options: Remove front post from 48” shelving unit
QP-S-HOOKL (2)
Remarks: Assemble into four tier unit(s) with bottom shelf 12” above finished floor.

Shelving units to be assembled into L-shape as shown on plan. Posts shall be re moved along interior corner and hooks shall be attached where shelving units meet.

ITEM #10 SHELVING UNIT, ALL PLASTIC
Quantity: One (1)
Manufacturer: Quantum / Metro / Eagle Group
Model: QP243062VS-4
Remarks: Assemble into four tier unit(s) with bottom shelf 12” above finished floor.

ITEM #11 SHELVING UNIT, ALL PLASTIC, L-SHAPED ASSEMBLY
Quantity: One (1)
Manufacturer: Quantum / Metro / Eagle Group
Model: QP246062VS-4
QP244862VS-4
Options: Remove front post from 48” shelving unit
QP-S-HOOKL
Remarks: Assemble into four tier unit(s) with bottom shelf 12” above finished floor.

Shelving units to be assembled into L-shape as shown on plan. Posts shall be re moved along interior corner and hooks shall be attached where shelving units meet.

ITEM #12 SHELVING UNIT, ALL PLASTIC, L-SHAPED ASSEMBLY

Quantity: Two (2)
Manufacturer: Quantum / Metro / Eagle Group
Model: QP246062VS-4
QP244862VS-4
Options: Remove front post from 48” shelving unit
QP-S-HOOKL (2)
Remarks: Assemble into four tier unit(s) with bottom shelf 12” above finished floor.

Shelving units to be assembled into L-shape as shown on plan. Posts shall be re moved along interior corner and hooks shall be attached where shelving units meet.

ITEM #13 SHELVING UNIT, ALL PLASTIC
Quantity: One (1)
Manufacturer: Quantum / Metro / Eagle Group
Model: QP244262VS-4
Remarks: Assemble into four tier unit(s) with bottom shelf 12” above finished floor.

ITEM #14 MOP SINK STORAGE
Quantity: One (1)
Manufacturer: Eagle Group / John Boos / IMC Teddy
Model: F1916-VSCS
Options: Includes but not limited to: slanted top, holds (2) mops, hinged door with transverse rod handles & keyed locks, 8" deep mop sink with service faucet, (1) fixed shelf above mop sink, includes 30" spray hose & spray hose bracket, 430 stainless steel construction.

ITEM #15 SPARE NUMBER

ITEM #16 HAND SINK
Quantity: Three (3)
Manufacturer: Eagle Group / John Boos / Titan
Model: HSA-10-FAW
Options: 318496 Paper towel dispenser, wall mounted (3)
300602 Soap dispenser (3)
-LRS Left and right side splashes (3)
Sup Info: Furnish stainless steel mounting hardware of proper type for wall construction and to sustain weight while in use.

Construction Trade shall provide wall blocking as required for mounting.

Foodservice Equipment Contractor to verify soap dispenser and paper towel dispenser type with the District.

ITEM #17 TRASH CAN, SLIM
Quantity: Three (3)
Manufacturer: Rubbermaid
Model: FG354060GRAY
Options: FG267360GRAY Lid (3)

ITEM #18	POT SHELF, WALL MOUNT
Quantity:	One (1)
Manufacturer:	Eagle Group / John Boos / Titan
Model:	WSP1260-14/3
Options:	300696 pothooks (5 additional)
Sup Info:	Furnish stainless steel mounting hardware of proper type for wall construction and to sustain weight while in use.
	Construction Trade shall provide wall blocking as required for mounting.

ITEM #19	REACH-IN REFRIGERATOR
Quantity:	One (1)
Manufacturer:	Traulsen / True / Beverage Air
Model:	G10010
Options:	Stainless steel interior Stainless steel exterior Stainless steel case back Full height hinged doors Hinge on left Field reversible doors Exterior mounted digital thermometer Automatic condensate evaporator Swivel casters with polyurethane tires and front locking brakes Plug and cord set 10’ cord Pan slide assembly, half section (top) Three shelves on bottom section (each)

ITEM #20	WARMING CABINET
Quantity:	One (1)
Manufacturer:	Vulcan / Cres cor / Cambro
Model:	VBP18
Options:	Stainless steel interior Stainless steel exterior Stainless steel case back Hinge on right Field reversible doors Exterior mounted digital thermometer CASTERS-RR4RIGID Casters, 5” (2 swivel) with locks Plug and cord set 10’ cord

ITEM #21	EXHAUST HOOD
Quantity:	One (1)
Manufacturer:	Accurex / Captive Aire
Model:	Size and shape as per plan
Construction:	Furnish and install exhaust hood.
	Entire exhaust ventilation system shall be constructed in compliance with UL, NSF, NFPA, IMC 2018 (including automatic start-up of the exhaust and supply ventilation upon activation of any cooking appliance) and any prevailing statutes and codes.

Hood shall be 14'-0" long constructed in two sections of 18 gauge 304 stainless steel with all seams continuously welded, ground smooth and polished. Provide a full compliment of stainless steel "high efficiency" baffle type grease extractors.

Furnish remote bulb thermostat with watertight hardware and install in either the exhaust plenum of the hood or in the exhaust duct. Provide NEMA 3 control panel box with hinged front cover complete with supply and exhaust fan contactors wired to an adjustable thermostat control, field wiring terminal strip and on-off switch.

Provide 18 gauge 304 stainless steel supply and exhaust duct collar.

Provide stainless steel threaded hanger rods complete with stainless steel mounting hardware for securing to structural ceiling.

Mechanical (HVAC) Trade shall furnish and install a complete exhaust air handling system including exhaust fan and controller, fan start-stop switch with status lights, 16 gauge insulated welded ductwork from exhaust collar on exhaust hood to fan, hinged roof curb with grease trough and removable grease container.

Mechanical (HVAC) Trade shall install exhaust hood heat detector(s) in exhaust hoods with multiple exhaust collars in the exhaust duct just after the point of the pant leg juncture; this includes punching of the required hole in the duct and installation of the heat detector and fitting.

Mechanical (HVAC) Trade shall furnish and install a complete supply air handling system including supply fan and controller (with maintainable filter system) and supply air heater with thermostat control (to temper incoming supply air below 65 degree F ambient), fan start-stop switch with indicator lights, galvanized steel ductwork from supply collar on exhaust hood to fan and roof curb.

Electrical Trade shall furnish and install interconnecting wiring between fan motors, controllers and switches.

Electrical Trade shall furnish and install inter-wiring of cooking appliance start-up inter-lock device and the supply and exhaust ventilation system and wire per the manufacturer's instructions and per applicable codes.

Furnish four (4) UL listed vapor-proof recessed LED light fixtures wired to a common on-off switch with stainless steel cover plate located on front face of control package/wall mounted utility cabinet.

Electrical Trade shall furnish materials and inter-wire light fixtures to switch on front face of utility cabinet.

Mechanical (HVAC) Trade shall furnish and install INVERTER DUTY THREE PHASE exhaust fan and controller.

Mechanical (HVAC) Trade shall furnish fans set compatible with variable frequency drive specification.

Electrical Trade shall furnish and install Interconnecting wiring of the system between the exhaust hood sensors and exhaust and supply fan motors.

Furnish and install 18 gauge stainless steel ceiling closure panels extending from the top of the exhaust ventilator to the finished ceiling. Panels shall be removable without the use of tools for access.

Furnish and install 18 gauge 304 stainless steel wall panels extending from the bottom of the rear of the exhaust hood to the upper edge of the baseboard molding and extending along the full length of all wall surfaces. Wall panel sections shall be fitted with ½" wide off-set seams at intermediate joints to allow panel sections to fit tightly against the wall and to result in watertight seams. Secure wall panels to building wall with wall panel adhesive of proper type for wall construction. Seal end seams with General Electric or equivalent clear silicone sealer.

Electrical Trade shall provide the inter-wiring between the control enclosure, fire system, supply and exhaust fans and duct riser temperature switch.

Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM #21.1 UTILITY DISTRIBUTION SYSTEM
Quantity: One (1)
Manufacturer: Accurex / Captive Aire
Model: Size and shape as per plan
Construction: Furnish and install utility distribution system.

Utility distribution system shall be fabricated in accordance with UL, NSF, NEC, IMC 2018.

Utility distribution system shall be fabricated of a minimum of 18 gauge 304 stainless steel consisting of two utility compartments and fabricated in sections as required with factory pre-assembled field connections and furnished with one primary end riser with single point connection for all utilities and one secondary end riser.

Primary riser shall be furnished with built-in exhaust hood controls, including push button fan control switches with status lights, individual and shunt-trip main circuit breaker and emergency “kill” button with guard.

Provide as part of raceway exhaust hood interlock device to prevent all electrically and gas operated cooking appliances from operating unless the supply and exhaust fans of the exhaust hood is operating as required by all local and prevailing codes including IMC 2009.

Provide raceway with splash proof electrical chase with copper wire-way wired to a circuit breaker panel box with ground fault protection for each appliance in the primary end riser, and UL listed power cords and matching electrical receptacles as required.

Provide raceway with gas supply (looped) service with shut-off valves for each disconnect hose or connection and safety retainer cables for each mobile appliance. Provide as part of utility distribution system, mechanically operated gas supply line shut-off valves to interrupt gas supply to all gas operated cooking appliances. Gas valves shall be provided with manual reset to prevent gas flow to pilot devices on appliances prior to restart.

Provide raceway with hot and cold water service with shut-off valves for each disconnect hose or connection and safety retainer cables for each mobile appliance.

Provide each riser with ventilator connecting collars for positive connection to the exhaust hood.

Provide secondary end riser with hinged access door for mounting of gas supply line shut-off valve (looped gas service).

Furnish and install labor and material to assemble all internal interconnecting gas piping, water piping and electrical wiring to install the utility distribution system. Test all connections for leaks.

ITEM #21.2 HOOD CONTROL PANEL
Quantity: One (1)
Manufacturer: Accurex / Captive Aire
Model: Size and shape per plan
Sup Info: Furnish 18 gauge stainless steel utility and fire system enclosure cabinet with hinged access doors for both hood and fire system controls and fire suppression tanks. System shall be listed by ETL (UL 508A) NSF, NFPA, IMC 2018 and any prevailing statutes or codes including automatic shut-down of all cooking appliances per code section 44 of NFPA 17-27. Cabinet may be freestanding wall type or integral with exhaust hood as shown on the contract drawings. Furnish stainless steel mounting hardware of proper type for wall construction for wall mounted cabinet.

Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM #22 WET CHEMICAL FIRE SUPPRESSION SYSTEM
Quantity: One (1)
Manufacturer: Ansul Fire Protection
Model: R-102
Sup Info: Furnish and install in exhaust hood and surface fire protection system.

Entire system shall be furnished and installed in compliance with UL, NSF,

NFPA, Factory Mutual, IMC 2018 and any prevailing statutes or codes including automatic shut-down of all cooking appliances per code section 44 of NFPA 17-27.

Furnish and install in exhaust hood as part of fire system, mechanically operated fusible link temperature detection system to activate entire fire system in event of fire.

All piping and nozzles of fire system shall be factory installed in exhaust hood, exposed piping, nozzles and fittings shall be chrome plated.

Inter-wiring of the fire system to the exhaust hood shall be furnished and installed by the Electrical Trade.

Electrical Trade shall furnish and install electric shunt-trip circuit breakers or electric shut-off contactors to interrupt electric power to all electrically operated cooking appliances.

Provide dry contacts in fire system to interface with building fire alarm system as required, electrical tie-in shall be the responsibility of the Electrical Trade.

Provide as part of fire system, mechanically operated gas supply line shut-off valve to interrupt gas supply to all gas operated cooking appliances. Gas valve shall be provided with manual reset to prevent gas flow to pilot devices on appliances prior to restart.

Provide one remote manual pull station to actuate fire system in the event of a fire.

Plumbing Trade shall install gas shut-off valve in gas supply line.

Electrical Trade shall furnish and install electric shunt-trip circuit breakers or electric shut-off contactors to interrupt electric power to all electrically operated cooking appliances.

Provide dry contacts in fire system to interface with building fire alarm system as required, electrical tie-in shall be the responsibility of the Electrical Trade.

Provide as part of fire system, start-up testing of the fire system as required by local fire codes. Subsequent testing of the fire system for a period of one year after start-up shall be included as part of this contract.

ITEM #23	REFRIGERATOR, UNDERCOUNTER
Quantity:	One (1)
Manufacturer:	True / Traulsen / Beverage Air
Model:	TUC-48-LP-HC~SPEC3
Options:	Stainless steel interior
	Stainless steel exterior
	Hinging per plan
	Exterior mounted digital thermometer

	Automatic condensate evaporator
	Swivel casters with polyurethane tires and front locking brakes
	Plug and cord set

ITEM #24	SHELVING UNIT, ALL PLASTIC
Quantity:	Two (2)
Manufacturer:	Quantum / Metro / Eagle Group
Model:	QP183674VS-5
Remarks:	Assemble into five tier unit(s) with bottom shelf 12” above finished floor.

ITEM #25	SOLID TOP COUNTER, CORNER
Quantity:	One (1)
Manufacturer:	Duke / LTI / Delfield
Model:	TTU-90SS
Options:	P-LAM Veneer plastic laminate on body
	ILD Internal locking device
	5" dia. gray poly swivel casters & brakes
	Owner/Architect to select laminate finish

ITEM #26	WORK TABLE, STAINLESS TOP
Quantity:	One (1)
Manufacturer:	Eagle Group / John Boos / Titan
Model:	T3096SE
Options:	E36A All welded construction
	E59 Undershelf upgrade
	Drawer

ITEM #27	MILK COOLER
Quantity:	One (1)
Manufacturer:	Traulsen / Beverage Air
Model:	RMC43S4
Options:	All stainless steel interior
	Swivel casters with polyurethane tires and front locking brakes
	Corner bumpers

ITEM #28	WORK TABLE, STAINLESS TOP
Quantity:	One (1)
Manufacturer:	Eagle Group / John Boos / Titan
Model:	T3696SE
Options:	E36A All welded construction
	E59 Undershelf upgrade
	Custom 20x28” Weld in sink bowl
	Sink cover
	Sink cover holder

ITEM #29	FLAT TOP COUNTER
Quantity:	One (1)
Manufacturer:	Duke / LTI / Delfield
Model:	TST-18SS
Options:	Owner/Architect to select laminate finish

3BTS-HD-1CU Tray slide, customer side
MOD-2S-1CU Kick plate, customer side
1/2" above floor for easy rolling
P-LAM Veneer plastic laminate on body
MOD-4P Veneer on customer side
MOD-P-END Veneer on end (where exposed)
ILD Interlocking device
5" dia. gray poly swivel casters & brakes

ITEM #30 COLD WELL, DROP-IN
Quantity: One (1)
Manufacturer: Duke / Multiteria / Delfield
Model: FCP4-SB
Options: 1127-2040 Asy Slant Kit, 4 section

ITEM #31 HOT/COLD/FREEZE, DROP-IN
Quantity: One (1)
Manufacturer: Duke / LTI / Delfield
Model: HCF-1

ITEM #32 FLAT TOP SERVING COUNTER
Quantity: One (1)
Manufacturer: Duke / LTI / Delfield
Model: TST-74SS
Options: Laminate finish to be selected by architect/owner
SOLID-HD-5CU Tray Slide, customer's side, (3) tubular Ø 1" bars, stainless steel, on hinged brackets, end caps, mounted 30"H
445-5S-HD-OP Cutting Board/Shelf , operator's side, 10"D, 18ga stainless steel shelf, (3) hinged brackets, shelf mounted flush to counter top
MOD-2S-5CU Kick plate, customer side, stainless steel
5” poly swivel casters & brakes
CUT-OP4 Rectangular cutout with reinforced turn down edges & corners welded closed, in counter top, body panel or a shelf (to accept HCF-3)
ILD Interlock device

ITEM #33 SNEEZE GUARD ASSEMBLY
Quantity: One (1)
Manufacturer: Duke / Premier Metal Glass / Versaguard
Model: BGA1-74-SS-GF-L
Options: Size and shape per plan
Stainless steel tubing, posts and framing
3/8" Tempered glass
End panels
TS400LED-4 LED light under shelf & wired to base
TS400HT-4 Radiant Heater, under shelf & wired to base
Remote Infinite
Millwork undercounter mount

ITEM #34 HOT WELLS, DROP-IN
Quantity: One (1)

Manufacturer: Duke / LTI / Delfield
Model: WW-4-120
Options: Waterless

ITEM #35 FLAT TOP SERVING COUNTER
Quantity: One (1)
Manufacturer: Duke / LTI / Delfield
Model: TST-88SS
Options: Laminate finish to be selected by architect/owner
SOLID-HD-6CU Tray Slide, customer's side, (3) tubular Ø 1" bars, stainless steel, on hinged brackets, end caps, mounted 30"H
445-6S-HD-OP Cutting Board/Shelf , operator's side, 10"D, 18ga stainless steel shelf, (3) hinged brackets, shelf mounted flush to counter top
MOD-2S-6CU Kick plate, customer side, stainless steel
5" poly swivel casters & brakes
CUT-OP4 Rectangular cutout with reinforced turn down edges & corners welded closed, in counter top, body panel or a shelf (to accept HCF-3)
ILD Interlock device

ITEM #35.1 SNEEZE GUARD ASSEMBLY
Quantity: One (1)
Manufacturer: Duke / Premier Metal Glass / Versaguard
Model: BGA2-88-SS-GF-UL
Options: Size and shape per plan
Stainless steel tubing, posts and framing
3/8" Tempered glass
End panels
TS400LED-4 LED light under shelf & wired to base
Remote Infinite
Millwork undercounter mount

ITEM #36 FROST ONLY COLD SHELF
Quantity: One (1)
Manufacturer: Duke / LTI / Delfield
Model: FTO2-SL

ITEM #37 CASHIER COUNTER
Quantity: One (1)
Manufacturer: Duke / LTI / Delfield
Model: TCS-30SS
Options: CS-DR-LK Stainless steel drawer, with lock and keys
ILD Internal Locking Device
MOD-2S-2CR Kick Plate, cashier's right
MOD-2S-2OC Kick Plate, opposite cashier
P-LAM Veneer plastic laminate on body
MOD-2P-CR Veneer on cashier's right
MOD-2P-OC Veneer opposite cashier
5" dia. gray poly swivel casters & brakes
Owner/Architect to select laminate finish

ITEM #38	P.O.S. SYSTEM
Quantity:	One (1)
Sup Info:	Not in Foodservice Equipment contract, furnished by the District.

ITEM #39	POT RACK, WALL MOUNT
Quantity:	One (1)
Manufacturer:	Eagle Group / John Boos / Titan
Model:	WSP1236
Options:	300696 Additional pot hooks (3)
Sup Info:	Includes (3) double pronged pot hooks.

Furnish stainless steel mounting hardware of proper type for wall construction and to sustain weight while in use.

Construction Trade shall provide wall blocking as required for mounting.

ITEM #40	THREE COMPARTMENT SINK
Quantity:	One (1)
Manufacturer:	Eagle Group / John Boos / Titan
Model:	314-18-3-24
Options:	313296 Pre-rinse faucet 313297 Add-a-faucet 301190 Pre-rinse wall bracket 313294 Splash mount faucet 341189 Twist handle drain (3) -TB Twist bracket (3) 326271 Sink cover (3) E47 Sink cover holder

ITEM #41	POT SHELF, WALL MOUNT
Quantity:	One (1)
Manufacturer:	Eagle Group / John Boos / Titan
Model:	WSP1260-14/3
Options:	300696 pothooks (5 additional)
Sup Info:	Furnish stainless steel mounting hardware of proper type for wall construction and to sustain weight while in use.

Construction Trade shall provide wall blocking as required for mounting.

ITEM #42	CLEAN DISHTABLE
Quantity:	One (1)
Manufacturer:	Eagle Group / John Boos / Titan
Model:	CDTR-72-14/3
Options:	Provisions for table limit switch

ITEM #43	BLOWER/DRYER, WAREWASHER
Quantity:	One (1)
Manufacturer:	San-Aire Industries / Insinger
Model:	PD-100-M

ITEM #44	FOOD WASTE DISPOSER
Quantity:	One (1)
Manufacturer:	Salvajor / In-sinkerator / Red Goat
Model:	300-SA-ARSS-LD-PP
Options:	PP PP-type control panel with mounted solenoid valve, flow control & pressure switch for all controls 980105 Mounting bracket DP Dejamming prong SLE6SS Seismic flange for leg support
Sup Info:	Foodservice Equipment Contractor shall furnish and install interconnecting piping and all components or parts as required by disposer manufacturer or as supplied as part of disposer in accordance with the manufacturer instructions. Foodservice Equipment Contractor shall furnish and install all interconnecting wiring as required between disposer motor and control device. Mount to control panel to wall or mounting bracket with stainless steel mounting hardware of proper type for application. Construction Trade shall reinforce wall as required to support weight of control panel while in use.

ITEM #45	DOOR TYPE WAREWASHER
Quantity:	One (1)
Manufacturer:	Insinger / Hobart / Champion
Model:	CX20
Options:	Single Point Drain water tempering kit Water hammer arrestor Brass pressure regulator

ITEM #46	CONDENSATE HOOD
Quantity:	One (1)
Manufacturer:	Accurex / Captive Aire
Model:	Size and shape per plan
Construction:	Furnish and install condensate hood. Entire condensate ventilation system shall be constructed in compliance with UL, NSF and any prevailing statutes and codes. Fabricate entire hood of 18 gauge 304 stainless steel fully welded watertight construction. Provide stainless steel welded hanger mounting clips with threaded stainless steel hanger and structural ceiling providing necessary angles and channels and utilizing stainless steel mounting hardware. Mechanical (HVAC) Trade shall provide stainless steel welded ductwork (horizontal duct runs shall be pitched back toward condensate hood) and fan to comprise a complete condensate exhaust system.

Electrical Trade shall install fan switch with indicator lights located on dish machine and inter-wire to fan.

Furnish and install plastic drain tubing from nipple on bleeder drain outlet to soiled dishtable top surface.

Furnish and install 18 gauge stainless steel ceiling closure panels extending from the top of the exhaust ventilator to the finished ceiling. Panels shall be removable without the use of tools for access.

Furnish and install 18 gauge 304 stainless steel wall panels extending from the bottom of the rear of the exhaust hood to the upper edge of the baseboard molding and extending along the full length of all wall surfaces. Wall panel sections shall be fitted with ½" wide off-set seams at intermediate joints to allow panel sections to fit tightly against the wall and to result in watertight seams. Secure wall panels to building wall with wall panel adhesive of proper type for wall construction. Seal end seams with General Electric or equivalent clear silicone sealer.

Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM #47	SOILED DISHTABLE
Quantity:	One (1)
Manufacturer:	Eagle Group / John Boos / Titan
Model:	SDTCL-108-14/3-MOD
Options:	Size and shape per plan E41 Disposal provision package -SRP Dishtable Kit, includes scrap basket, rack slide & T & S pre-rinse 313297 T&S Add-A-Faucet, 12" spout 300720 Lever Handle Drain -TB Twist bracket

ITEM #48	TRASH RECEPTACLE, 55 GAL
Quantity:	One (1)
Manufacturer:	Rubbermaid
Model:	FG265500GRAY
Options:	FG265400GRAY Lid FG264000BLA Dolly

ITEM #49	WASHER
Quantity:	One (1)
Sup Info:	Not in Foodservice Equipment contract, furnished by the District.

ITEM #50	DRYER
Quantity:	One (1)
Sup Info:	Not in Foodservice Equipment contract, furnished by the District.

ITEM #51 SPARE NUMBER

ITEM #52 SHELVING UNIT, ALL PLASTIC
Quantity: One (1)
Manufacturer: Quantum / Metro / Eagle Group
Model: QP246062VS-4
Remarks: Assemble into four tier unit(s) with bottom shelf 12” above finished floor.

ITEM #53 SHELVING UNIT, ALL PLASTIC
Quantity: One (1)
Manufacturer: Quantum / Metro / Eagle Group
Model: QP244862VS-4
Remarks: Assemble into four tier unit(s) with bottom shelf 12” above finished floor
ITEM #54 SHELVING UNIT, ALL PLASTIC, L-SHAPED ASSEMBLY
Quantity: One (1)
Manufacturer: Quantum / Metro / Eagle Group
Model: QP244874VS-5 (2)
Options: Remove front post from 48” shelving unit
QP-S-HOOKL
Remarks: Assemble into five tier unit(s) with bottom shelf 12” above finished floor.

Shelving units to be assembled into L-shape as shown on plan. Posts shall be re moved along interior corner and hooks shall be attached where shelving units meet.

ITEM #X-01 EXISTING COMBI-OVEN
Quantity: One (1)
Sup Info: Refer to Specification Section 2.6, Standards for Existing Equipment; survey the existing item of equipment to be reused to determine the extent of reconditioning or repairs necessary to place equipment in proper working order.

ITEM #X-02 EXISTING CONVECTION OVEN
Quantity: One (1)
Sup Info: Refer to Specification Section 2.6, Standards for Existing Equipment; survey the existing item of equipment to be reused to determine the extent of reconditioning or repairs necessary to place equipment in proper working order.

END OF SECTION 11 40 00

SECTION 11 61 43 - STAGE CURTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stage curtains.
2. Draw-curtain tracks.

B. Related Requirements:
1. Section 061000 "Rough Carpentry."

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product and the following:
1. Tracks: Capability of each track to support the weight and operation of curtains that it supports.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
1. Include plans, elevations, sections, and attachment details of curtains.
2. Include fabric assembly and hanging details.
3. Dimension operating clearances.
4. Include documentation of capacity of each track and attachment to support loads.

C. Samples for Initial Selection: For each type of stage curtain indicated. Include color charts showing full range of colors, textures, and patterns available, together with 12-inch-square Sample (any color) of each fabric type and seam.

D. Samples for Verification: Full width by minimum 36-inch-long section of each fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.

E. Delegated-Design Submittal: For stage-curtain systems and attachments to structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which tracks will be attached.

2. Locations of lighting fixtures and cabling, ductwork, piping, and sprinklers.

G. Qualification Data: For Installer and professional engineer.

H. Product Certificates: For the following, from manufacturer:
1. Fabric: Provide name of flame-retardant chemical used, identification of applicator, treatment method, application date, allowable life span for treatment, and details of any restrictions and limitations.

I. Sample Warranty: For manufacturer's special warranty.

J. Operation and Maintenance Data: For stage curtains to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of stage curtains.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not install stage curtains until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and 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. Field Measurements: Verify locations of supporting structural elements and construction contiguous with stage curtains and rigging by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of stage-curtain systems that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, faulty operation of track system.
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND SUPPLIERS

A. Rigging System: Equipment shall be manufactured as listed below:
1. Stage Curtain Tracks: The stage curtain tracks shall be manufactured by:
a. The Automatic Devices Co.
b. J.R. Clancy Inc.
c. Atlas Silk by H&H Specialties
d. Tiffin Scenic Studios

3. Stage Curtain Fabrics: The stage curtain fabrics shall be as manufactured by:

a. KM Fabrics Inc.
b. Valley Forge Fabrics
c. Melfabco Inc.
d. Gerriets International
e. J. B. Martin Company
f. Frankel Associates
g. Dazian

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stage-curtain systems, including comprehensive engineering analysis and attachments to building structure, using performance requirements.

B. Structural Performance: Stage-curtain systems and attachments to structure shall withstand the effects of gravity and operational loads and the following loads and stresses:
1. Design Loads: Weight of curtains.

C. Fire-Test-Response Characteristics: Provide stage curtains meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
1. Flame-Propagation Resistance: Passes NFPA 701.
a. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals and whether it requires retreatment after cleaning or after a designated time period of use.
b. Permanently attach 12-inch-square swatch of same fabric and dye lot for each fabric of a curtain assembly to the back of assembly for use as fire-resistance test strip.

2.3 CURTAIN FABRICS

A. General: Provide fabrics inherently and permanently flame resistant or chemically flame resistant by immersion treatment according to performance requirements indicated. Provide fabrics of each type and color from same dye lot.

B. Lightweight Woven Cotton Velour: Napped fabric of 100 percent cotton weighing not less than 13.5 oz./linear yd., with pile height not less than 59 mils; 54-inch minimum width.
1. Products: Subject to compliance with requirements, provide the following:
a. Gerriets International; Venice.
2. Color/Texture/Pattern: As selected by Architect from manufacturer's full range.

2.4 LINING

A. Polyester Lining: 100 percent polyester fabric; inherently and permanently flame resistant; 54-inch minimum width; black.

2.5 CURTAIN-BOTTOM WEIGHTS

A. Weight Tape: Curtain manufacturer's standard, continuous weight tape to suit each curtain type and location.

2.6 CURTAIN FABRICATION

A. General: Affix permanent label, stating compliance with requirements of authorities having jurisdiction, in accessible location on fabric not visible to audience. Provide vertical seams unless otherwise indicated. Arrange vertical seams so they do not fall on faces of pleats. Do not use fabric cuts less than one-half width. Orient velour fabric with the fabric nap down.

B. Vertical and Top Hems: Machine sew hems as follows unless otherwise indicated:

1. Vertical Hems: Minimum 2 inches wide,with not less than a 1-inch tuck and with no selvage material visible from front of curtain. Sew open ends of hems closed.
2. Top Hems: Reinforced by double-stitching 3-1/2-inch-wide, heavy, jute or laminated synthetic webbing to top edge on back side of curtain with not less than 2 inches of face fabric turned under.

C. Fullness:
1. Flat: Provide zero percent fullness in curtains.

D. Grommets: Brass, No. 3, or No. 4.
1. Flat Curtains: Place 12 inches o.c. and 1 inch from corner of curtain; for snap hooks.

E. Bottom Hems: Machine sew hems as follows unless otherwise indicated:
1. For Flat Curtains Without Fullness: 4-inch lined hem with pocket for sliding pipe or conduit weight and stiffener into bottom of curtain.
2. Lining: Where indicated, provide lining for curtain in same fullness as face fabric and finished 2 inches shorter than face fabric. Sew or otherwise securely attach lining to top hem of face fabric. Attach lining to face fabric alongside seams with 4-inch-long strips of heavy woven cotton tape.

2.7 CURTAIN ACCESSORIES

A. Snap Hooks: Manufacturer's standard heavy-duty hooks, blind sewn to top hem of curtain.

2.8 ALUMINUM CURTAIN TRACK

A. Aluminum Track: Extruded aluminum, ASTM B 221; alloy and temper as recommended by manufacturer for strength and corrosion resistance; black paint finish; complete with necessary accessories for support and operation.
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. Automatic Devices Company; 140 series, Rig-I-Flex.
2. Curved Track: Fabricate curved portions of track on-site.

3. Cable Guides for Curved Track: Outside idlers, mule pulleys, spindles, and guides; quantity sufficient for configuration of curve(s) and length of track.
4. Aluminum Thickness: 0.090 inch.

B. Curtain Rails: Single or double curtain capacity as indicated. Provide end stops for track rails.

C. Curtain Carriers: Standard carriers with a pair of nylon-tired ball-bearing wheels riveted parallel to plated-steel body. Equip carriers with rubber or neoprene bumpers and nylon glide strips to reduce noise, and heavy-duty, plated-steel swivel eye for attaching curtain snap or S-hook. Provide quantity of curtain carriers sufficient for track length, to suit curtain fabrication.
1. Master Curtain Carriers: One master carrier, for each leading curtain edge, with two pairs of nylon-tired ball-bearing wheels riveted parallel to plated-steel body.

D. Curved-Suspended-Track Stiffener: NPS 1-1/2 steel pipe for supporting both sections of suspended curved tracks; curved to match track.

E. Clamp and Bracket Hangers: Steel clamps and brackets of sufficient strength required to support loads for attaching track to overhead support.

F. Manual Walk-Along Operation: Fabricate curtain track without cord, cable, pulleys, or floor pulley.

2.9 Pipe Battens: All stage battens shall be 1-1/2 in. nominal diameter schedule 40 pipe 78 ft in length as shown on the drawings. All joints shall be sleeve spliced with 18 in. long sleeves with 9 in. extending into each pipe and held by two (2) 3/8 in. hex bolts and lock nuts on each side of the joint. The ends of each batten shall be covered with a bright yellow plastic cap for safety.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting performance of stage-curtain work.

B. Examine inserts, clips, blocking, or other supports required to be installed by others to support tracks and battens.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install stage-curtain system according to curtain and track manufacturer's written instructions.

3.3 TRACK INSTALLATION

A. Ceiling-Mounted Track: Drill track at intervals not greater than manufacturer's written instructions for spacing, and fasten directly to structure.

B. Track-Support Spacing: According to manufacturer's recommendations for applied loads, but not exceeding the following dimensions between supports:
   1. Curved Walk-Along Track: 48 inches, with additional supports at curves and splices.

3.4 CURTAIN INSTALLATION

A. Track Hung: Secure curtains to track carriers with snap hooks.

3.5 DEMONSTRATION

A. Stage Draperies: Upon completion of the work, the Contractor shall submit all required copies of a detailed Operating and Maintenance Manual including as-built shop drawings, equipment descriptions, and parts lists.
   1. The Contractor shall go through the manual with Owner-designated personnel to demonstrate and explain the maintenance and operation for all of the systems.
   2. The proper handling and operation of the system shall be clearly and fully explained to those personnel who will be directly responsible to operate the stage equipment.

3.6 CLEAN-UP

A. The Contractor shall be responsible for clean-up, including removal of packing materials etc. and the protection of surfaces or equipment provided by other contractors.

3.7 PROTECTION

A. Protect all equipment after installation from damage during construction. If despite such protection, damage occurs, remove and replace damaged components or entire unit as required to restore all units to their original, undamaged condition.

END OF SECTION 11 61 43

SECTION 11 66 23 - GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following athletic equipment:
   1. Basketball backstop assemblies, including support framing.
   2. Volleyball standards.
   3. Wall-mounted and column safety pads.
   4. Electronic scoreboards.
   5. Master equipment controller.

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete": Oversized recessed voids to be cast in concrete subfloors and footings.
   2. Division 05 Section "Structural Steel": Structural supports not provided by athletic equipment manufacturer for supporting athletic equipment to building structure.
   3. Division 08 Section "Door Hardware": Lock cylinders and keying.
   4. Division 09 Sections "Wood Athletic Flooring": Coordination of recessed standards with gym flooring.
   5. Division 26 Sections: Electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized gymnasium equipment.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Provide basketball backstops capable of withstanding the effects of earthquake motions determined according to the building code in effect for this Project or ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads," whichever is more stringent.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, features, and finishes. Include details of anchors, hardware, and fastenings. If applicable, include assembly, disassembly, and storage instructions.

B. Shop Drawings: Show location and extent of fully assembled athletic equipment. Include elevations, sections, and details not shown in Product Data. Show method of field assembly, connections, installation details, mountings, floor inserts, attachments to other Work, operational clearances, and relationship to adjoining work.
   1. Blocking and Reinforcement: Show locations of blocking and reinforcement required for support of athletic equipment.
   2. Setting Drawings: For cast-in floor insert sleeves for post standards.
   3. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for supporting athletic equipment and for seismic

restraint. Verify capacity of members and connections to support loads and verify loads, point reactions, and locations for attachment of athletic equipment to structure with those indicated on Drawings.

C. Coordination Drawings: Court layout plans and elevations drawn to scale and coordinating oversized recesses for deferred installation of floor insert sleeves, floor-insert penetrations and game lines and markers applied to finished flooring.

D. Samples for Initial Selection: For each type of athletic equipment indicated.

E. Maintenance Data: For athletic equipment to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer employing workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of athletic equipment through one source from a single manufacturer.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install athletic equipment until spaces are enclosed and weatherproof, 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.

B. Field Measurements: Verify position and elevation of floor inserts and layout for athletic equipment. Verify dimensions by field measurements.

1.6 COORDINATION

A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.

B. Coordinate layout and installation of overhead-supported athletic equipment and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Basketball Equipment:
      a. Institutional Products, Inc.
      b. Jaypro Sports, Inc.

c. Performance Sports Systems, Inc.
d. Porter Athletic Equipment Co.

2. Volleyball Equipment:
   a. Jaypro Sports, Inc.
   b. Performance Sports Systems, Inc.
   c. Porter Athletic Equipment Co.
3. Wall-Mounted Safety Pads: As noted on Drawings or
   a. Institutional Products, Inc.
   b. Jaypro Sports, Inc.
   c. Performance Sports Systems, Inc.
   d. Porter Athletic Equipment Co.
4. Electronic Scoreboards:
   a. Fair-Play Products.
   b. Nevco Scoreboard Co.
   c. Daktronics, Inc.
5. Master Equipment Controller:
   a. Jaypro Sports, Inc.

2.2 MATERIALS, GENERAL

A. Steel: Comply with the following:
   1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M, hot-dip galvanized.
   2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53.
   3. Cold-Formed Steel Tubing: ASTM A 500, Grade A, unless another grade is required by structural loads.
   4. Steel Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513 or steel tubing fabricated from steel complying with ASTM A 569/A 569M and complying with the dimensional tolerances in ASTM A 500.
   5. Malleable-Iron Castings: ASTM A 47, grade required by structural loads.
   6. Support Cable: 1/4-inch-diameter, 7x19 galvanized steel aircraft cable with a breaking strength of 7000 lb. Provide fittings complying with cable manufacturer's written recommendations for size, number, and method of installation.

B. Anchors, Fasteners, Fittings and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed tamperproof. Provide as required for athletic equipment assembly, mounting, and secure attachment.

C. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 with minimum strength recommended in writing by athletic equipment manufacturer.

2.3 BASKETBALL EQUIPMENT

A. Ceiling suspended, side fold, side braced: Complete assembly spanning height indicated on Drawings, including primary and secondary superstructure support framing to building structure, pipe and cable bracing, adjustable hangers, clamps, cables, chains, pulleys, fittings, hardware, and fasteners.
   1. Basis-of-Design: Item No. 90955-000 Side Fold Backstop; Porter Athletic Equipment Co.

2. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
    a. Provide additional 3-1/2 inch O.D. pipe and vertical extensions to anchor frame to structure above.
    b. Finish: Manufacturer's standard factory-applied, baked powder-coating finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness; white.
3. Folding Type: Provide manufacturer's standard assembly for side folding, backstop, with hardware and fittings to permit folding.
4. Goal Height Adjuster: Adjustable from 8 to 10 feet with crank mechanism, locking in any position within adjustment range, with visible height scale and finish matching framing.
    a. Operation: Motor mounted with backstop, for use with hand-held power stick.
        1) Basis-of-Design Product: Item No. 602-506 with Powr-Stick; Porter Athletic Equipment Co.

B. Wall-Mounted Backstops: Complete assembly extending from wall, including support framing to building structure, bracing, cables, chains, pulleys, fittings, hardware, pipe anchors, equipment pads, and fasteners.
1. Basis-of-Design: Item No. 90220-000 Side Fold Backstop; Porter Athletic Equipment Co.
2. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
    a. Finish: Manufacturer's standard factory-applied, baked powder-coating finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness; black.
3. Folding Type: Provide manufacturer's standard assembly for upward- backstop, as indicated, with hardware and fittings to permit folding.
4. Goal Height Adjuster: Adjustable from 8 to 10 feet with crank mechanism, locking in any position within adjustment range, with visible height scale and finish matching framing.
    a. Operation: Motor mounted with backstop, for use with hand-held power stick.
        1) Basis-of-Design Product: Item No. 602-506 with Powr-Stick; Porter Athletic Equipment Co.

C. Backstop/Backboard Safety Device: Designed to limit free fall if support cable, support chain, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb load capacity; one per folding backstop.
1. Basis-of-Design: Model No. 1100 Safe Stop; Performance Sports.
2. Retractor Device: Manufacturer's standard device designed to retract both support and safety cables, chains, and straps away from play of the basketball when backstop is in playing position; one per folding backstop.
    a. Basis-of-Design Product: Retractor Reel, Item No. 10798-000; Porter Athletic Equipment.

D. Electric Operator: Provide factory-assembled electric operator for backstop designed for lifting and lowering basketball equipment of type, size, weight, construction, use, and operation frequency indicated. Provide operation system, of size and capacity and with features, characteristics, and accessories suitable for Project conditions, recommended by gymnasium equipment manufacturer; complete with winch or hoist designed to move and hold backstop in any raised or lowered position, electric motor and factory-prewired motor controls with limit controls, remote-control stations, remote-control devices, power disconnect switch, enclosures protecting controls and all operating parts, and accessories required for proper operation. Include wiring from motor controls to motor. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.
   1. Basis-of-Design Product: Item No. 00706-000; / 00707-000; Porter Athletic Equipment.
   2. Comply with NFPA 70.
   3. Winch: Consisting of heavy-duty, fully enclosed worm gear reducer, belt and sprocket drive, cable drum, cable, and fittings.
   4. Electric Motor: UL-approved or -recognized, totally enclosed, insulated, capacitor-start motor, complying with NEMA MG 1, with thermal-overload protection, brake, and permanently lubricated bearings; sized to start and operate size and weight of basketball equipment considering Project's service conditions without exceeding nameplate ratings or considering service factor.
      a. Motor Characteristics: Single phase, sized by gymnasium equipment manufacturer; 115 V, 60 Hz.
   5. Operator Mounting: Wall, on equipment mounting pad.
   6. Remote Controls: Master equipment controller.
   7. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop basketball equipment at fully retracted and fully lowered positions.

E. Basketball Backboards: Provide predrilled holes or preset inserts for mounting goals.
   1. Basis-of-Design for Overhead-Supported Backstop: Item No. B-208-000; Porter Athletic Equipment Co.
   2. Description: Rectangular, not less than 1/2-inch-thick, transparent tempered glass. Provide glass with impact-absorbing, resilient rubber or PVC gasket around perimeter in a fully welded frame, with steel subframe, reinforcement, and bracing, including center-strut frame reinforcement, and with mounting slots for mounting backboard frame to backstop support framing.
   3. Target Area and Border Markings: Permanently etched.
   4. Rim-Restraining Device: Complying with NCAA and NFHS rules and designed to ensure that basket remains attached if glass backboard breaks.

F. Goal Mounting Assembly: Compatible with goal, backboard, and support framing.
   1. Glass Backboard Goal Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backboard frame and to minimize stresses on glass backboard.

G. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.

1. Basis-of-Design for Overhead-Supported Backstop: Power-Flex goal and net, Item No. 233; Porter Athletic Equipment Co.
2. Type: Movable, breakaway design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.
3. Finish: Manufacturer's standard factory-applied, baked powder-coating finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness; orange.

H. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit rim diameter.

I. Safety Pads: Provide safety pads designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports.
1. Basis-of-Design Product: Backboard Safety Padding Kits, No. 00227-000; Porter Athletic Equipment Co.

2.4 VOLLEYBALL STANDARD SLEEVES

A. Floor Insert: Floor plate; and steel pipe sleeve, concealed by floor plate, with capped bottom end; with anchors designed for securing floor insert to floor substrate as indicated.
1. Basis-of-Design: Model No. 851-900; Porter Athletic Equipment Co.

B. Sleeves: Flush sleeves with covers for installation in concrete floor.
1. Basis-of-Design: Model No. 870-000; Porter Athletic Equipment Co.

C. Standards and Nets: Not in Contract.

2.5 WALL-MOUNTED FIXED AND REMOVEABLE SAFETY PADS

A. Safety Pad Surface-Burning Characteristics: Provide safety pads with flame-spread index of 25 or less and smoke-developed index of 450 or less, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Pad Covers: Provide safety pad fabric covers fabricated from puncture- and tear-resistant, not less than 14-oz. PVC-coated polyester or nylon-reinforced PVC fabric treated with fungicide for mildew resistance, with the fire-test-response characteristics indicated, lined with fire-retardant liner.
1. Flame-Resistance Ratings: Passes NFPA 701.

C. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to OSB backer board with visible surfaces fully covered by seamless fabric cover, free from sag and wrinkles and firmly attached to back of backer board.
1. Basis-of-Design: 400 Series – Fixed, 724 Series - Removable; Mancino Mats.

2. Fill: Multiple-impact-resistant foam not less than 2-inch-thick polyurethane, 3.5-lb density.
3. Installation Method: Manufacturer's standard concealed fastening.
4. Fabric Covering: 14 oz. vinyl-laminated nylon.
5. Fabric Cover Color: As indicated on Drawings, or if not indicated, as selected by Architect from manufacturer's full range.
6. Cut-out Moldings: Provide size and quantity of manufacturers standard pre-molded cut-out inserts as required.
7. Mounting Clips: Provide top and bottom extruded aluminum mounting clips to continuously support panels to wall.

2.6 MASTER EQUIPMENT CONTROLLER

A. Master controller to replace keyswitches for gymnasium equipment, equipped to operate all the basketball backstops, gym divider curtains, and other equipment as indicated.
1. Basis-of-Design Product: MEC-99 Master Equipment Controller; Jaypro Sports, Inc.
2. Controller: Consisting of a keypad manufactured of heavy duty screened rubber enclosed in a high density cast plastic frame; capable of operating 99 pieces of equipment; with capability of controlling maintained contact type relays and momentary contact type.
3. Security: Controller is fully programmable by user to change security codes or change equipment being controlled.
4. Control Power: Operates with 12V direct current; switching mechanisms requiring keys or line voltage at the switch are not acceptable.
5. Mounting: Unit mounts in a standard two-gang box.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, and other conditions affecting performance.
1. Verify critical dimensions.
2. Examine supporting structure and below finished floor for subfloors and footings.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked for installers. Locate reinforcements and mark locations if not already done.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of athletic equipment. Complete equipment field assembly, where required.

B. Unless otherwise indicated, install athletic equipment after other finishing operations, including painting, have been completed.

C. Permanently Placed Athletic Equipment and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.
   1. Floor Insert Location: Coordinate location with application of game lines and markers.
   2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and type of floor plate.
   3. Operating Athletic Equipment: Verify clearances for movable components of athletic equipment throughout entire range of operation and for access to operating components.

D. Floor Insert Setting: Grout sleeve for post standards in oversized, recessed voids in concrete slabs and footings. Clean holes of debris. Position sleeve and fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

E. Wall Safety Pads: Mount with bottom edge at 4 inches above finished floor, unless otherwise indicated.

F. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing built-in and permanently placed athletic equipment to structural support and for properly transferring load to in-place construction.

3.3 ADJUSTING AND PROTECTION

A. Adjust movable components of athletic equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

B. After completing athletic equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

C. Provide final protection and maintain conditions acceptable to manufacturer and Installer that ensure athletic equipment is without damage or deterioration at time of Substantial Completion.

D. Replace athletic equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain athletic equipment. Refer to Division 01 Section "Closeout Procedures."

END OF SECTION 11 66 23

SECTION 12 24 13 - WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:
   1. Manual roller shades (WS-01).
   2. Automatic roller shades (WS-02).

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry": Blocking for support of window shade brackets.
   2. Division 09 Section Gypsum Board Assemblies: Gypsum board substrate for window shade systems.
   3. Division 09 Section Acoustical Ceilings: Shade pockets, pocket closures, and accessories.
   4. Division 22 Electrical: Connections to electrical motor control system and lighting control system components.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and mounting requirements.

B. Shop Drawings: Include plans, elevations, sections, details, operational clearances, and attachments to other work.
   1. Motorized Shades: One-line wiring system diagrams including connection details and overall arrangement of shades and control locations.

C. Samples for Initial Selection: For each type of shade material and exposed metal showing full range of colors and patterns available.

D. Samples for Verification: For each type of roller shade.

   1. Shade Material: Not less than 10 inches square. Mark face of material to indicate interior faces.
   2. Exposed Metal: Full-size unit, not less than 10 inches long.

E. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, and instructions for operating hardware and controls to include in operation and maintenance manuals.

F. Qualification Data: For manufacturer.

G. Manufacturer's Certificates: For each product, signed by product manufacturer.

H. Sample warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Minimum 20 years' experience in manufacturing products comparable to those specified in this Section.

B. Installer Qualifications: Qualified to install and commission specified products by prior factory training, experience, demonstrated performance, and acceptance of any requirement of the manufacturer, subsidiary of the manufacturer, or licensed agent.

C. Source Limitations: Obtain roller shades and electrical control equipment for complete installation through one source from a single manufacturer.

D. Mockups:
   1. Provide mockup of window shade complete with selected shade fabric including sample of seam when applicable.
   2. Locate where directed.
   3. Approved mockup may [not] remain as part of the Work.

E. Surface-Burning Characteristics: As determined by testing identical products according to NFPA 701 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. 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.

G. Preinstallation Conference: Conduct conference at Project site.

   1. Review methods and procedures related to installation of window shades including, but not limited to, the following:
      a. Coordination with related work including electrical services.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver shades until concrete, masonry, painting, and other wet work is complete and dry.

B. Deliver shades to project in protective packaging, labeled to identify each shade for each opening.

C. Store products in manufacturer's unopened packaging until ready for installation.

1.5 PROJECT CONDITIONS

A. Do not install shades until building is operating at ambient temperature and humidity and ventilation levels for project upon completion.

B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 COORDINATION

A. Ensure that locating templates and other information required for installation of roller shades are furnished to other trades.

B. Coordinate construction of surrounding conditions to allow for timely field dimension verification.

1.7 WARRANTY

A. General Warranty: The special warranty 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. Hardware and Shade Fabric Warranty: Submit a written limited warranty executed by the manufacturer agreeing to repair or replace hardware and shade fabric that fail in materials or workmanship within the specified warranty period.
   1. Warranty Period: 25 years from date of Substantial Completion.

C. Motor and Controls Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace motorized roller shades that fail in materials or workmanship within the specified warranty period.
   1. Failures include, but are not limited to, controls, electronic accessories, and motors.
   2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products by Draper, Inc., or comparable products by one of the following:
   1. Lutron Electronics Co., Inc.
   2. MechoShade Systems, Inc.

2.2 MANUALLY OPERATED ROLLER SHADES (WS-01)

A. Basis-of-Design Product: Manual FlexShade XD with spring assist.

B. Description: Manually operated, vertical roll-up, fabric window shade with all components required for complete installation.

C. 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.
   1. Clutch mechanism: Fabricated from high carbon steel and molded fiberglass reinforced polyester or injected molded nylon.
      a. Color: Black.

2. Bead chain loop: Stainless steel bead chain hanging at side of window.
3. Idler Assembly: Roller idler assembly of molded nylon with adjustable or spring-loaded length idler pin to facilitate easy installation, and removal of shade for service.
4. Bead Chain Hold Down: P-Clip (standard).

D. 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 and to eliminate horizontal impressions in fabric.

E. Shade Slat: Slat encased in heat seamed hem.

F. Mounting:
1. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size.
a. Endcap covers: Color as selected by Architect from manufacturer's standard range.

G. Fascia: L shaped aluminum extrusion to conceal shade roller and hardware.
1. Attachment: Snaps onto endcaps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands. No notching is required.
2. Shape: Square Fascia Panel.
3. Color: To match end cap color.

H. Shade Fabric: Light filtering fabric.

2.3 SHADE FABRIC

A. Shade Fabric Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric:
1. Mermet; E Screen: PVC coated fiberglass yarn woven in 2 by 2 basketweave.
2. Thickness: 020 inch thick.
3. Openness Factor: 1 percent average.
4. Color: As selected by Architect from manufacturer’s standard range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.

B. Examine shade fabric before installation. Reject shade fabric that is wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved Shop Drawings.

B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.

C. Install shades to provide smooth operation.

D. Connect to building electrical system.

3.3 ADJUSTING

A. Test window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 DEMONSTRATION

A. Demonstrate proper operation and maintenance of window shades to Owner's designated representatives.

3.6 SCHEDULE

A. Refer to Drawings for shade types and locations.

END OF SECTION 12 24 13

SECTION 12 32 16 - MANUFACTURED LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Plastic-laminate-faced wood cabinets of stock design.
   2. Plastic-laminate countertops.
   3. Solid surfacing material countertops
   4. Backsplashes and side splashes

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry": Wood blocking for anchoring institutional casework.
   2. Division 06 Section "Architectural Woodwork": Custom plastic laminate woodwork.
   3. Division 08 Section "Door Hardware": Requirements for masterkeying locks to building keying system.
   4. Division 09 Section "Gypsum Board Assemblies": Reinforcements in gypsum board partitions for anchoring institutional casework.
   5. Division 09 Section "Resilient Flooring": Resilient base applied to institutional casework.
   6. Division 22 Sections: Sinks and faucets.
   7. Division 26 Sections: Electrical work, including undercabinet lighting fixtures.

1.2 DEFINITIONS

A. 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.

B. Semiexposed 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 semiexposed.

C. 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.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Shop Drawings:
   1. Show fabrication and installation details for institutional casework. Include plans, elevations, sections, large-scale details of cabinet construction, sink locations, and attachments to other

B. Work .Samples for Verification:

1. 6 inch square Samples for each type of finish, including top material and the following:
   a. Section of countertop showing top, front edge, and backsplash construction. For Manufacturers other than Basis-of-Design manufacturer, submit the following:
      1) One full-size finished base cabinet of each type complete with hardware, doors and drawers, but without countertop.
      2) One full-size finished wall cabinet complete with hardware, doors, and adjustable shelves.
      3) Maintain full-size Samples at Project site during construction in an undisturbed condition as a standard for judging the completed Work.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. An authorized representative of institutional casework manufacturer for installation and maintenance of units required for this Project. Manufacturer Qualifications:
      a. An experienced manufacturer with not less than 5 years producing modular casework of type indicated for Project, with a published catalog and national distribution, and a record of successful in-service performance.

B. Source Limitations:
   1. Obtain institutional casework through one source from a single manufacturer. Manufacturer shall be Certified Participant in AWI's Quality Certification Program.

C. Quality Standard:
   1. Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards," Sections 10 and as follows:
      a. Grade: Premium. Style: Flush overlay.
      b. Product Designations: Drawings indicate sizes, configurations, and finish material of institutional 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. Refer to Division 01 Section "Product Requirements."
      c. Hard English Dimensions: Provide base and wall cabinets that establish finished counter top and clearance dimensions without shimming top or expanding or reducing base. Cabinets shall be fabricated in Hard English dimensions to correspond to dimensions indicated on Drawings.
      d. Accessibility: Comply with applicable requirements of the Americans with Disabilities Act "Accessibility Guidelines" (ADAAG), together with ANSI A117.1 "Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People."

1.5 PRODUCT HANDLING

A. Deliver institutional 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 "Project Conditions" Article.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:
1. Do not deliver or install institutional casework until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements:
1. Where institutional casework is indicated to fit to other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

C. Established Dimensions:
1. Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating institutional casework without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate layout and installation of metal framing and reinforcements in gypsum board assemblies for support of institutional casework.

1.8 WARRANTY

A. Special Warranty:
1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of institutional casework that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
a. Delamination of components or other failures of glue bond.
b. Warping of components. Failure of operating hardware.
c. Deterioration of finishes. Warranty Period: 5 years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish complete touchup kit for each type and finish of institutional casework provided. Include scratch fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged casework finish.

B. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

C. Supply one full sheet, as supplied by plastic laminate manufacturer, for each color plastic laminate used in the work. Supply 5 yards of vinyl edge trim for each thickness and color used in the work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product for Cabinets: The design for institutional casework is based on Stevens Advantage 1200 Traditional Series; Stevens Industries, Inc., Teutopolis, IL. Manufacturer of Plastic-Laminate Material: As indicated by manufacturer's designations on the Drawings. Provide the specified product or a comparable product by one of the following:
   1. TMI.
   2. LSI Corporation of America, Inc.
   3. Mastercraft Woodworking Co., Inc
   4. American Millwork and Cabinetry, Inc.
   5. Case Systems

2.2 MATERIALS

A. General:
   1. Softwood Plywood: DOC PS 1.
   2. Particleboard: ANSI A208.1, Grade MZ-Exterior Glue.
   3. Core Material: Formaldehyde-free core material of recycled, annually-renewable, blended bio-fiber; ANSI A208.1, Grade M3.
      a. Face Screw Holding: 284 lbs.
      b. Edge Screw Holding: 254 lbs.
      c. Internal Bond: 112 psi.
      d. Hardness: 500 lbs.
      e. Modulus of Rupture: 2541 psi.
      f. Modulus of Elasticity: 399,000 psi.
   4. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
   5. Laminating Adhesive: Hybrid P.V.A. Type III water resistant adhesives.
   6. Edgebanding for Plastic Laminate: Colors selected by Architect from manufacturer's full range, and as follows:
      a. Typical Edging at Doors, Drawer Faces and Exposed Shelving:
      b. Rigid PVC extrusions, through color with satin finish, 3 mm thick.
   7. Cabinet Body Edging: 3 mm high-impact color-through PVC for cabinet end panels, top, bottom, door/drawer front spacer rail, and shelf; length beveled both sides.
   8. Interior Cabinet Edging: Flat edge PVC matching cabinet interior surface color, for interior dividers and top of drawer body.
   9. Exposed Cabinet Materials:
      a. Plastic Laminate:
         1) Type VGS. Unless otherwise indicated, provide plastic laminate for exposed surfaces.
   10. Markerboard Facing: For cabinet doors indicated, provide markerboard surface complying with requirements specified in Division 10 Section "Visual Display Surfaces."

11. Semiexposed Cabinet Materials:
    a. Melamine-Faced Core Material:
        1) Core Material with decorative surface of thermally fused, melamine-impregnated web and complying with LMA SAT-1. Provide melamine-faced core material for semiexposed surfaces, unless otherwise indicated.
12. Concealed Cabinet Materials: Plastic laminate; Type BKL.
13. Steel Counter Support Brackets; Type and spacing as indicated or if not indicated, as recommended by casework manufacturer for required support.

2.3 DESIGN, COLOR, AND FINISH

A. Design:
1. Provide institutional casework of the following design:
    a. Flush overlay with wire pulls. Set door and drawer fronts inset flush between cabinet end panels, with nominal 1/16 inch reveal between pairs of doors, door and drawer fronts, doors and end panel, and between multiple drawers.
2. Plastic-Laminate Colors, Patterns, and Finishes:
    a. As indicated by product designations on the Drawings.
3. Melamine-Faced Core Material Colors, Patterns, and Finishes:
    a. As selected by Architect from casework manufacturer's full range.
4. Powder Coated Metal Finish:
    a. As selected by Architect from casework manufacturer's full range.

2.4 CABINET FABRICATION

A. Plastic-Laminate-Faced Cabinet Construction:
1. Bottoms and Ends of Cabinets, Shelves, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch core material, plastic-laminate faced on exposed surfaces, melamine faced on semiexposed surfaces.
2. Backs of Cabinets: 3/8-inch core material, plastic-laminate faced on exposed surfaces, melamine faced on semiexposed surfaces.
    a. Construct structural cabinet body with backs inset 7/8 inch from rear of cabinet body, fully housed four sides, and back-shimmed.
    b. Provide 3/4 inch thick stiffeners glued and fastened to back and body; with back perimeter and stiffeners fully sealed with hot melt adhesive.
3. Cabinets Over 36 Inches Wide: Provide mechanically fastened, removable, vertical divider to control horizontal member or shelf deflection.
4. Hang Rails: Provide 3/4 inch thick hang rails glued to backside and mechanically fastened to end panel of wall, base and tall cabinets.
5. Wall Cabinet Interior Depth: 12 inches clear with door closed.
6. Drawer Fronts: 3/4-inch core material, plastic-laminate faced on both sides; applied to separate drawer body component subfront.
7. Drawer Bodies: 1/2-inch core material, melamine faced on both sides, onset bottoms. Drawer sides dadoed and glued to receive front and back, machine squared and held under pressure while hot melt glued and pinned together. Drawer bottom 1/4 inch minimum, recessed 1/2 inch up from bottom of drawer body, fully captured in dados on 4 sides, sealed with hot melt adhesive. Provide drawer bottom stiffeners glued and mechanically fastened to bottom and body for drawers as follows:

8. Drawers less than 24 inches wide: Provide one stiffener from front to back.
9. Drawers from 24 to 36 inches wide: Provide two stiffeners from front to back.
10. Drawers from 36 to 48 inches wide: Provide three stiffeners from front to back.
11. Paper Storage Drawers: Fitted with full width hood at back.
12. Flat File Drawers: Reinforce inside front inside corners of drawer box with metal angles fastened to drawer body. Provide full width hood at rear top of drawer body extending forward 4 inches.
13. Doors: 3/4-inch core material, plastic-laminate faced on both sides. Drill cabinet bodies to receive shelves with holes coordinated with shelf clip pin diameter and spaced at 32 mm on center. Cut recess into door edges with butt hinges to allow for hinge thickness. Gaps at door edges shall be even with no variation between any door edge. Comply with gap allowances of referenced standard. Provide valance in wall cabinets shown with undercabinet lighting fixtures, and coordinate cabinet construction to accommodate installation, support and wiring for light fixtures.
14. Subbase: Support floor mounted cabinets with subbase of separate, continuous ladder-type platform design, fabricated from exterior grade plywood. Recess at exposed cabinet ends 1/4 inch to permit field installation of base. No continuous sides to floor on cabinets will be permitted.
15. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and equipment. Fabricate from same material and with same finish as cabinets.

2.5 CASEWORK HARDWARE

A. Hardware, General:
1. Provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware complying with requirements indicated. Use threaded metal or plastic inserts with machine screws for fastening to core material except where hardware is through-bolted from back side.
2. Hinges:
   a. Typical Locations: Provide powder coated steel, semiconcealed, 5-knuckle butt 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.
3. For Cabinets in Rooms Listed Below: Provide Frameless Concealed Hinges (European Type), BHMA A156.9, B01602, with between 135 to 165 degrees of opening, self-closing.
4. Pulls: Solid steel, powder coated, wire pulls, fastened from back with two screws. For sliding doors, provide recessed stainless-steel flush-pulls. Provide 2 pulls for drawers more than 24 inches wide.
5. Door Catches: Dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches high.
6. Drawer Slides: Powder-coated, bottom mounted, metal-channel, and self-closing drawer slides with outstop, instop and out-keeper, designed to prevent rebound when drawers are closed, with nylon-tired, ball-bearing rollers, and complying with BHMA A156.9, Type B05091, and rated for the following loads:
7. Box Drawer Slides: 100 lbf. dynamic load, minimum 150 lbf. static load.
8. File Drawer Slides: 200 lbf. dynamic and static load rating.

9. Flat File/Paper Storage Drawer Slides: 200 lbf. dynamic and static load rating, and full extension.
10. Cabinet Door and Drawer Locks: Cylindrical (cam) type, 5-pin tumbler, brass with chrome-plated finish, complying with BHMA A156.11, Grade 1.Provide a minimum of two keys per lock and six master keys.Provide locks for all doors and drawers. Masterkey cabinet door and drawer locks to building keying system according to Owner's keying instructions.
11. Adjustable Shelf Supports: 2-pin locking plastic shelf rests complying with BHMA A156.9, Type B04013.

2.6 COUNTERTOPS

A. Countertops, General:
   1. Provide smooth, clean exposed tops and edges in uniform plane free of defects. Provide front and end overhang of 1 inch over base cabinets.
   2. Plastic-Laminate Tops: Plastic-laminate sheet, shop bonded with waterproof glue to both sides of 3/4-inch plywood or core material. Sand surfaces to which plastic laminate is to be bonded.
   3. Plastic-Laminate Type for Flat Tops: HGS.
   4. Plastic-Laminate Type for Backing: BKL. 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. Use exterior plywood or phenolic-resin-bonded core material for countertops containing sinks.

B. Solid-Surfacing Material Tops: ½ inch thick sheets adhesively applied to composite wood understructure. Provide front and end overhang of 1 1/8 inch over base cabinets.
   1. Color and Pattern as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of institutional casework.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CASEWORK INSTALLATION

A. Install plumb, level, and true; shim as required, using concealed shims. Where institutional casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
   1. Base Cabinets: Set subbase and cabinets straight, level, and plumb. Secure subbase to floor before installing cabinet bodies. Adjust subtops within 1/16 inch of a single plane. Fasten cabinets to partition framing, wood blocking, or reinforcements in 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. Fasten subbase to floor with fasteners spaced 24 inches o.c. Secure bottom of cabinets to subbase with no less than two fasteners per cabinet.

2. 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, partition framing, blocking, or reinforcements in partitions. Align similar adjoining doors to a tolerance of 1/16 inch. Fasten through back, near top and bottom, at ends, and not more than 16 inches o.c. with the following: Toggle bolts through metal backing, metal framing behind wall finish or cells of concrete masonry. No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips. Hanging strips only may be employed when fully concealed at sides of cabinets. 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. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer. Adjust catches to engage doors positively and hold close and for hinges to operate without binding. If catch or hinges cannot be adjusted to meet these criteria, readjust cabinet installation to allow for proper hinge and catch operation.

3.3 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. 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. Secure tops to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each front, end, and back. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and walls with adhesive. Seal junctures of top, splash, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer. Comply with requirements specified in Division 07 Section "Joint Sealants."

3.4 UTILITY SHELVING INSTALLATION

A. Install wall racks according to wall rack manufacturer’s written instructions.

3.5 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 32 16

SECTION 12 66 00 - TELESCOPING STANDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Wall-attached stationary stands (bleachers).

B. Related Sections include the following:

1.2 DEFINITIONS

A. Telescoping stands are operable systems of multiple-tiered benches or chairs on interconnected, folding platforms that close, without being dismantled, into a nested stack for storing or moving.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance Characteristics: Engineer, fabricate, and install telescoping stands to withstand the design loads specified in NFPA 102, "Standard for Assembly Seating, Tents, and Membrane Structures," Chapter 5, "Folding and Telescopic Seating," without exceeding the allowable design working stresses of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each respective component of each telescoping stand unit.

B. Accessibility Standard: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

1.4 SUBMITTALS

A. Product Data: Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: Show fabrication and installation of telescoping stands including plans, elevations, sections, details of components, and attachments to other units of Work.
   1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Include layout of row letters and seat numbers.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each exposed material involving color selection.

D. Samples for Verification: Prepare Samples from the same material to be used for the Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1. Molded-Plastic Benches: Manufacturer's standard color chips in 2 by 2 inch pieces.
2. Lumber: 12-inch-long samples of finished board.
3. Deck Material: 12-inch-square samples of finished material.
4. Painted Steel: 6-inch-square sample of painted steel sheet.

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. Maintenance Data: Include detailed instructions for operation and annual inspection requirements of authorities having jurisdiction, to include in the operation and maintenance manual specified in Division 01.

1.5 QUALITY ASSURANCE

A. NFPA Standard: Comply with requirements of NFPA 102, "Standard for Assembly Seating, Tents, and Membrane Structures," Chapter 5, "Folding and Telescopic Seating," except where more stringent requirements are indicated or imposed by authorities having jurisdiction.

B. Installer Qualifications: Engage an experienced Installer to perform work of this Section who has specialized in installing types of telescoping stands similar to those required for this Project and who is acceptable to, or certified by, manufacturer of telescoping stands.

C. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the 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 telescoping stands that are similar to that indicated for this Project in material, design, and extent.

D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code-Steel" and AWS D1.3 "Structural Welding Code-Sheet Steel."
1. Engage certified welders that have satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, have undergone recertification.

E. Engineering Responsibility: Engineer telescoping stands by qualified professional engineer legally authorized to practice in jurisdiction where Project is located.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check actual dimensions of construction affecting telescoping stands by accurate field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating telescoping stands without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products by Universal; Interkal, Inc. or comparable product by one of the following:
   1. Hussey Seating Co.
   2. Irwin Seating Company; Folding Bleacher Company Subsidiary.

2.2 MATERIALS

A. Lumber: Kiln-dried, surfaced 4 sides, southern pine complying with SPIB "Standard Grading Rules for Southern Pine Lumber" for C and Better finish grade requirements.
   1. Lumber Form: Provide one of the following:
      a. Solid lumber complying with DOC PS 20 requirements, finger joined to provide required length.
      b. Edge-glued and finger-joined lumber complying with SPIB "Glued-Lumber Standard for Southern Pine" requirements.
      c. Solid lumber complying with DOC PS 20 requirements, finger joined to provide required length or edge-glued and finger-joined lumber complying with SPIB "Glued-Lumber Standard for Southern Pine" requirements.
   2. Nominal Thickness: 1 inch.

B. Plywood: Softwood plywood panels, 5/8-inch nominal thickness, 5-ply construction with grade designation American Plywood Association (APA) A-C Exterior, with solid crossbands, Group 1 veneer species for plies, and exterior glue, APA grade trademarked, complying with DOC PS 1 requirements, unless otherwise noted.

C. Plywood deck boards shall be fabricated from Douglas Fir Premium Underlayment with exterior glue, 5 ply minimum, solid cross band directly under face ply, species Group 1 and manufactured in accordance with APA grade trademarked PS 1.
   1. Basis-of-Design Product: Panelam.
   2. Overlay Thickness: Minimum 0.030 inch.
   3. Overall Panel Thickness: 19/32 inch.
   4. Overlay Texture: Slip resistant.
   5. Overlay Color: Polyethylene plastic, light gray in color.
   6. Panel Splices: Extruded aluminum "H" section designed to tightly engage plywood panels.

D. Structural Steel Shapes, Plates, and Bars: ASTM A 36, except where higher strength steel is indicated or standard with manufacturer.

E. Commercial-Quality Uncoated Steel Sheet: ASTM A 366 cold-rolled steel sheet, or ASTM A 569 hot-rolled steel sheet, stretcher leveled.

F. Structural-Quality Uncoated Steel Sheet: ASTM A 570 hot-rolled steel sheet, or ASTM A 611 cold-rolled steel sheet, stretcher leveled.

G. Steel Tubing: ASTM A 500, cold formed; or ASTM A 501, hot formed.

H. Extruded Aluminum: ASTM B 221, alloy as standard for manufacturer.

I. Polyethylene Plastic: ASTM D 1248, Type III, Class B; molded, color-pigmented, textured, impact-resistant, structural formulation.

J. Fasteners: Vibration proof, of size and material standard with manufacturer.

2.3 COMPONENTS

A. General: Provide manufacturer's standard telescoping stands fabricated to comply with requirements indicated. Smoothly round corners, edges, and exposed fasteners to eliminate snagging and pinching hazards. Form exposed sheet metal with flat, flush surfaces, true to line and level, and without cracking and grain separation. Perform welding by operators and processes complying with AWS requirements.

B. Bench Seats and Skirts: Provide seats with 18 inch wide one-piece individual seating modules with uniform heights of not less than 16 inches or more than 18 inches, as standard with manufacturer.
   1. Material: Polyethylene plastic.
   2. Colors: As selected by Architect from manufacturer’s full range.
   3. Profile: Contoured seat surface.
   4. Depth: 10 inches.
   5. Each module shall have a full 1/2 inch interlock to the adjacent module both around the perimeter and along the internal ribs to eliminate pinching hazards and ensure proper alignment.
   6. Each module shall have a nominal 2-inch by 1-inch recessed area for seat numbering.
   7. End caps of same material as seat module shall be provided at the ends of each bank of seating and at each aisle.
      a. Each end cap shall have a nominal 2-inch by 1-inch recessed area for row letter.

C. Accessible Seating Knock-outs: Provide ADA accessible seating areas in locations indicated. Locate pairs symmetrically throughout each bank while avoiding aisles and providing companion seats.
   1. Knock-outs shall be capable of recovering conventional seating in areas of knock-outs by removing guard rail and manually pulling out recoverable seating.
   2. Provide removable guard rails.

D. Risers: Fabricate risers from steel sheet with painted or galvanized finish, as standard with manufacturer.

E. Footrests: Fabricate fully closed footrests from finished decking material, as standard with manufacturer.

F. Understructure: Fabricate understructure from structural steel members of size, spacing, and form required to support design loads.
   1. Cantilever bench seat supports to produce toe space uninterrupted by vertical bracing.

G. Support Column Wheels: Provide manufacturer's nonmarring, soft, rubber-face wheel assembly under each support column. Include wheels of size, number, and design required to support stands and to achieve smooth operation without damage to flooring surface, but not less than 4 per column or less than 3-1/2 inches in diameter and 1 inch wide.

H. Aisles: Fabricate stands with the following aisle configuration, at locations and of widths indicated:
   1. Footrest-Level Configuration: Interrupt seats to provide aisle walking surfaces at footrest level.
      a. Provide manufacturer's standard automatic aisle closures to produce flush vertical face at aisles when system is stored.
      b. Provide manufacturer's standard metal nosing for aisles with wood walking surfaces.

I. Row Spacing: Fabricate units with row spacing of 24 inches, unless otherwise indicated.

J. Row Rise: Fabricate units with row rise of between 9-5/8 and 10-1/2 inches, as standard with manufacturer.

K. Operation: Provide telescoping stands incorporating manufacturer's standard system of seating and understructure members that permit opening and closing of adjacent rows, allow individual and collective rows to be locked open for use, and close with vertical faces of upper skirts in the same vertical plane.
   1. Manual Operation: Provide manual operation of stands by portable operator handles that attach to center of stand units and allow 1 or 2 operators to work from upright position.

L. Types of Telescoping Stands: Provide assemblies of the following types, fabricated in lengths and number of rows indicated on Drawings:
   1. Wall-Attached Type: Construct stands to provide for permanent attachment of rear of understructure to wall construction.

M. Accessories: Provide the following accessories of manufacturer's standard design and construction at locations indicated or required to comply with referenced code standard:
   1. Center Aisle: Provide a permanently-attached, self-storing aisle rail which is designed to eliminate all labor associated with set up and storage of the aisle rails.
   2. End railings of telescoping, self-storing type, 42-inch height.
   3. Rear fillers including supports for closing openings between top row and rear wall of adjoining construction.
   4. Flexible covering for all exposed ends of stands in open position.

2.4 STEEL FINISHES

A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel complying with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).

B. Rust-Inhibitive Finish: Immediately after cleaning and pretreating, apply manufacturer's standard rust-inhibitive baked enamel finish to exposed and concealed metal surfaces including understructure, except where other types of finishes are indicated.

2.5 WOOD FINISHES

A. Transparent Finish: Prepare surfaces by machine sanding, supplemented by hand sanding where required, followed by application of sealer coats and transparent topcoats of type, in number, and by process standard with manufacturer. Apply to wood surfaces, except where otherwise indicated.

B. Painted Plywood: Manufacturer's standard wear-resistant finish in manufacturer's standard color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where telescoping stands are to be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of telescoping stands. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install telescoping stands to comply with manufacturer's instructions and Shop Drawings. Provide accessories indicated and anchors, fasteners, inserts, and other items required for installing and attaching units to adjoining construction.

B. Install row letters in recessed areas on end panels and seat numbers in recessed areas on seat modules per row letter/seat number layout in approved shop drawings.

3.3 ADJUSTING AND CLEANING

A. On completion of installation, including work of other trades, lubricate, test, and adjust each telescoping stand unit to operate easily and to comply with manufacturer's specifications.

B. Clean installed telescoping stands on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.
   1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   2. Train Owner's maintenance personnel on procedures and schedules related to operation, troubleshooting, servicing, inspection, and maintenance.

3. Review data in the operation and maintenance manuals.
4. Schedule training with Owner, through Architect, with at least 7 days advance notice.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure telescoping stands are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 12 66 00

SECTION 14 24 00 – HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 Summary

A. This section specifies hydraulic 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.

1.2 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 50 00 – Temporary Facilities and Controls: protection of floor openings and personnel barriers; temporary power and lighting.
2. Section 03 30 00 – Cast-In-Place Concrete: elevator pit, elevator motor and pump foundation, and grouting thresholds.
3. Section 04 20 00 – Unit Masonry: masonry hoistway enclosure, building-in and grouting hoistway doorframes, and grouting of sills.
4. Section 05 50 00 – Metal Fabrications: pit ladder, divider beams, supports for entrances and rails, and hoisting beam at top of elevator hoistway.
5. Section 07 16 00 – Cementitious Waterproofing: waterproofing of elevator pit.
6. Section 23 50 00 – Heat Generation Equipment: ventilation and temperature control of elevator equipment areas.
7. Section 26 05 00 – 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 30 00 – Emergency (Standby) Power Supply Systems: emergency generator for elevator operation.
9. Section 27 30 00 – Voice Communications: ADAAG-required emergency communications equipment.

10. Section 28 31 00 – 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 10 00 – Site Clearing: excavation for cylinder well casing.

1.3 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.

1.4 System Description

A- Equipment Description: Hole-less Hydraulic elevator with machine-room less application

B- Equipment Control: Otis GCS Controller.

C. Quantity of Elevators: 1

D. Elevator Stop Designations: 1, 2

E. Stops: 2

F. Openings: Front Only

G. Travel: 16’-0”

H. Rated Capacity: 3000

I. Rated Speed: 100 fpm

J. Platform Size: 6’-6 3/4” W x 6’-2 3/4” D

K. Clear Inside Dimensions: 6' 5 9/16" x 5' 0 3/16"

L. Cab Height: 93”

M. Clear Cab Height: 7’-4 5/16” (2243 mm)

N. Entrance Type and Width: Single Slide - 3'6"

O. Entrance Height: 84”

P. Main Power Supply: 480 volts □ 5% of normal, three-phase, with a separate equipment grounding conductor.

Q. Car Lighting Power Supply: 120 volts, single-phase, 15 amps, 60 Hz.

R. Machine Location: No machine-room required, tank and controller in hoistway pit.

S. Signal Fixtures: Manufacturer's standard with metal button targets (excluding CA).

T. Controller Location: In a machine space or closet

U. 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.

V. 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.

W. Operation Features – Optional

1. Zoned Access at Bottom Landing.
2. Zoned Access at Upper Landing.
3. Express Priority Service with key-switch(es)
4. Emergency Hospital Service.
5. Automatic Rescue Operation
6. Automatic Standby Power Operation with Manual Override.

X. 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, 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.

Y. Provide equipment for seismic conditions: No

1.5 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.

1.6 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.

1.7 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.

1.8 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 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.

1.9 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 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.

PART 2 - **PRODUCTS**

2.1 Manufacturer

A. Manufacturer: Design based upon Otis HydroFit™ machine room-less elevator system.

2.2 Design and Specifications

A- Provide hydraulic 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. The entire hydraulic system and the controller shall be located inside the hoistway. No extra machine room or control closet space is required.
2. LED lighting standard in ceiling lights and elevator fixtures.
3. Sleep mode operation for LED ceiling lights and car fan.

B. Approved Installer: Otis Elevator Company

2.3 Equipment: Machine Components

A. The hydraulic system shall be of compact design suitable for operation under the required pressure. The power component shall be mounted in the hydraulic-fluid storage tank. The control valve shall control flow for up and down directions hydraulically and shall include an integral check valve. A control section including control solenoids shall direct the main valve and control: up and down starting,

acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering. All of these functions shall be fully adjustable for maximum smoothness and to meet contract conditions. System to be provided with a low-pressure switch and a shut-off valve.

B. The entire hydraulic system with hydraulic-fluid storage tank, power component and valves shall be located in the hoistway pit and be easily accessible for maintenance through an access door in the hoistway wall.

C. A microprocessor-based controller shall be provided, including necessary starting switches together with all relays, switches, solid-state components and hardware required for operation, including door operation, as described herein. A three (3) phase overload device shall be provided to protect the motor against overloading.

D. The controller shall be located together with the hydraulic system in the hoistway pit and be easily accessible for maintenance through the same access door that is also used for the hydraulic system. The controller will be located in the optional remote machine room if selected.

E. A manual lowering feature shall permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.

F. Pressure Switch

G. Tank Heater- Optional

H. Low-oil control (where required)

2.4 Equipment: Hoistway Components

A. Plunger(s) and Cylinder(s): Each cylinder shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. Each plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Each plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder. Each plunger and cylinder shall be installed plumb and shall operate freely with minimum friction.

B. Car Guide Rails: Tee-section steel rails with brackets and fasteners.

C. Polyurethane type buffers shall be used.

D. Wiring: Wiring for hoistway electrical devices included in scope of the elevator system, hall panels, pit emergency stop switch, and the traveling cable for the elevator car.

E. 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.
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 1-1/2 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.

2.5 Equipment: Car Components

A. Cab: Steel Shell Cab with raised laminate wall panels

Brushed Stainless Steel finished vertical trim pieces are optional.

B. Car Front Finish: Brushed Stainless Steel.
C. Car Door Finish: Brushed Stainless Steel.
D. Ceiling Type: Dropped ceiling with LED lights
E. Car Front Finish: Brushed Stainless Steel.
F. Car Door Finish: Brushed Stainless Steel.
G. Ceiling Finish: Brushed Steel Finish
H. 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.
I. 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.
J. Handrails: Brushed steel finish, 3/8” x 2” flat tubular bar handrails shall be provided on the side walls.
K. Threshold: Aluminum
L. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.
M. 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.

Note: Below are optional.

N. Certificate frame: Provide a Certificate frame with a Brushed Stainless Steel finish.
O. Otis cab UVC light purification device
P. Otis cab air purifier

2.6 Equipment: Signal Devices and Fixtures

1. 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. 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.

Note: Below are Standard for USA and optional in Canada.

h. In car stop switch (toggle or key unless local code prohibits use)

i. Firefighter's hat (standard USA)

j. Firefighter's Phase II Key-switch (standard USA)

k. Call Cancel Button (standard USA)

Note: Below are optional.

l. Firefighter's Phase II Emergency In-Car Operating Instructions: worded according to A17.1 2000, Article 2.27.7.2.

m. 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.

1. Integral Hall fixtures shall feature round stainless steel, mechanical buttons marked to correspond to the landings. Hall fixtures to be located in the wall. Buttons shall be in vertically mounted fixture. Fixture shall be Brushed Stainless Steel finish.

2. Button: Flat flush mounted, Brushed Stainless Steel button with blue or white LED illuminating halo

3. 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 is Optional

PART 3 - **EXECUTION**

3.1 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.

3.2 Installation

A. Installation of all elevator components except as specifically provided for elsewhere by others.

3.3 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 control systems and operating devices are functioning properly.

END OF SECTION 14 24 00

SECTION 20 01 00 - GENERAL PROVISIONS - MECHANICAL

1. GENERAL

A. The Advertisement for Bids, Instructions to Bidders, Bidding Requirements, General, Special and Supplementary Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub-Contractor's work. All manufacturers, suppliers, fabricators, contractors, etc. submitting proposals to any part if for work, services, materials or equipment to be used on or applied to this project are hereby directed to familiarize themselves with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.

B. Each Proposer shall also be governed by any unit prices and Addenda insofar as they may affect his part of the work or services.

C. The work included in this division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Mechanical System(s) indicated or specified in the Contract Documents.

D. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Mechanical Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and/or specifications, shall be included as part of this Contract.

E. It is not the intent of this section of the specifications to make any Contractor, other than the responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect then to the Engineer. Also, this section of the specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.

F. It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

G. In general, and to the extent possible, all work shall be accomplished without interruption of existing facilities operations. The Contractor shall advise the Owners at least two weeks prior to the interruption of any services or utilities. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will last.

Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.

H. Definitions and Abbreviations

(1) Contractor - Any Contractor whether proposing or working independently or under the supervision of a General Contractor and/or Construction Manager and who installs any type of mechanical work (Controls, Plumbing, HVAC, Sprinkler, etc.) or, the General Contractor.

(2) Engineer - The Consulting Mechanical-Electrical Engineers either consulting to the Owners, Architect, other Engineers, etc. In this case: CMTA, Inc., Consulting Engineers.

(3) Architect - The Architect of Record for the project.

(4) Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.

(5) Provide - Furnish and install complete, tested and ready for operation.

(6) Install - Receive and place in satisfactory operation.

(7) Indicated - Listed in the Specifications, shown on the Drawings or Addenda thereto.

(8) Typical - Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.

(9) Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Contract with Owners, etc.

(10) Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.

(11) OSHA - Office of Safety and Health Administration.

(12) The Project - All of the work required under this Contract.

(13) NEC - National Electrical Code.

(14) NFPA - National Fire Protection Association.

(15) ASME - American Society of Mechanical Engineers.

(16) SMACNA - Sheet Metal and Air Conditioning Contractors National Association.

(17) ANSI - American National Standards Institute.

(18) ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.

(19) NEMA - National Electrical Manufacturers Association.

(20) UL - Underwriters Laboratories.

(21) ADA - Americans with Disabilities Act.

(22) IMC - International Mechanical Code.

(23) IECC - International Energy Conservation Code.

I. Required Notices:

(1) Ten days prior to the submission of a proposal, each proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Proposers signify that they have included the cost of all required items in the proposal and that the Proposer will be responsible for the safe and satisfactory operation of the entire system.

2. INTENT

A. It is the intention of the Contract Documents to call for finished work, tested and ready for operation.

B. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

3. DRAWINGS AND SPECIFICATIONS

A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The drawings are not intended to show every item which may be necessary to complete the systems. All proposers shall anticipate that additional items may be required and submit their bid accordingly.

B. The drawings and specifications are intended to supplement each other. No Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Proposer shall request a clarification not less than twelve days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.

C. The drawings and specifications shall be considered to be cooperative and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

D. Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.

E. The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.

F. Should conflict or overlap (duplication) of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.

G. Unless dimensioned, the mechanical drawings only indicate approximate locations of equipment, piping, ductwork, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.

H. Each Proposer shall review all drawings including Architectural, Mechanical, Electrical, Fire Protection, Landscaping, Structural, Surveys, etc., to insure that the work he intends to provide does not encroach a conflict with or affect the work of others in any way. Where such effect does occur it shall be the Proposer's responsibility to satisfactorily eliminate any such encroachment conflict or effect prior to the submission of his proposal. Each Proposer shall in particular insure that there is adequate space to install his equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to insure adequate spaces.

I. Where on the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

J. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

K. Where on the Drawings or Addenda the word typical is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.

L. Special Note: Always check ceiling heights indicated on Architectural Drawings and Schedules and insure that they may be maintained after all mechanical and electrical equipment is installed. Do not install equipment in the affected area until the conflict is resolved.

4. EXAMINATION OF SITE AND CONDITIONS

A. Each Proposer shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. Each Proposer shall also fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. His proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after bids are accepted.

5. EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor requests approval of materials and/or equipment of different physical size, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, electrical services, etc., from that indicated. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall remunerate them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineers does not in any way absolve the Contractor of this responsibility.

B. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of Paragraph (A) immediately preceding

are met. Requested substitutions shall be submitted to the Engineer a minimum of twelve days prior to bids.

C. Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the Engineers.

D. Each Proposer shall furnish along with his proposal a list of specified equipment and materials which he is to provide. Where several makes are mentioned in the specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not insure that the Engineers will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings is satisfactorily comparable to the items specified and/or indicated.

6. SUPERVISION OF WORK

A. The Contractor shall personally supervise the work for which he is responsible or have a competent superintendent, approved by the Engineers, on the work at all times during progress with full authority to act for him.

7. CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.

A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, excluding all utility connections, meters, meter settings, taps, tap fees, extensions, water and/or sewer system development charge, etc. in connection with his work, these shall be by owner. He shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. He shall hire an independent Registered Engineer to witness installations and provide necessary certifications where required by utility companies, municipal agencies or others that have review authority. He shall also obtain all required certificates of inspection for his work and deliver same to the Engineers before request for acceptance and final payment for the work. Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall also be versed in all Codes, Rules and Regulations pertinent to his part of the work prior to submission of a proposal.

B. The Contractor shall include in his work, without extra cost, any labor, materials, services, apparatus and drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.

C. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.

D. All materials and equipment so indicated and all equipment and materials for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriters' Laboratories (UL), Incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable. Where required by the Code and/or the Authority Having Jurisdiction, provide the services of a field labeling agency to provide a UL label for the entire system in the field under evaluation.

E. All plumbing work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Department of Health. Plumbing work shall not commence until such plans are in the hands of the Contractor.

F. All Heating, Ventilation and Air Conditioning work shall be accomplished in accordance with the IMC and amendments thereto, the latest standards recognized by the American Society of Heating, Refrigerating and Air Conditioning and the National Fire Protection Association. Contractor shall secure a permit from the Division of HVAC. Final inspection certificate shall be provided by Contractor and a copy included in Operation and Maintenance Manuals.

G. All pressure vessel installations shall comply with the State, and/or Federal Code applicable. A Certificate of Final Boiler Inspection shall be required.

H. The Contractor shall furnish three (3) copies of all Final Inspection Certificates obtained to the Engineer when work is complete. Final payment for work will be contingent upon compliance with this requirement.

I. Where minimum code requirements are exceeded in the Design, the Design shall govern.

J. The Contractor shall ensure that his work is accomplished in accord with the OSHA Standards and that he conducts his work and the work of his personnel in accord with same.

K. Work in elevators, elevator shafts and elevator equipment rooms shall comply with the Elevator Code enforced by IBC

L. All work relating to the handicapped shall be in accord with regulations currently enforced by the Department of Housing, Buildings and Construction, and the American Disabilities Act.

M. All work in conjunction with a natural gas installation shall, in addition to all other Codes, Rules, Regulations, Standards, etc., comply with the requirements of the local gas supplier and/or standards and recommendations of the American Gas Association.

N. All work in relation to domestic water systems shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the requirements of the local water utility company and the adopted edition of the 10 States Standards.

O. All work in relation to the installation of sanitary or storm sewers shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the local agency governing such installations and the adopted edition of the 10 States Standards.

P. All work relating to the handicapped shall be in accord with regulations currently enforced by the Department of Housing, Buildings, and Construction, and the American Disabilities Act.

8. EQUIPMENT AND PIPING SUPPORT

A. Each piece of equipment, apparatus, piping, or conduit suspended from the structure or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc., as indicated or required by the Structural Engineer. This, in some instances, will require the Contractor to add an angle to a joist to transfer the load to a panel point. If in doubt, contact the Structural Engineer.

9. DUCT AND PIPE MOUNTING HEIGHTS

A. All exposed or concealed ductwork, piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, run perpendicular or parallel to the building structure.

10. COST BREAKDOWNS (SCHEDULE OF VALUES)

A. Within thirty days after acceptance of the Contract, the Contractor shall furnish to the Engineer, one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made in a format approved by the Engineer. Payments will not be made until satisfactory cost breakdowns are submitted.

11. CORRECTION PERIOD

A. All equipment, apparatus, materials, and workmanship shall be the best of its respective kind. The Contractor shall replace all parts at his own expense, which are proven defective as described in the General Conditions. The effective date of completion of the work shall be the date of the Architect's or Engineer's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer

with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period, due to negligence of his operator or other employees. Refer to other sections for any special or extra warranty requirements.

B. It is further clarified that all required and specified warranties shall begin on the date of Substantial Completion, not at the time of equipment start-up.

C. All compressors shall have five year warranty.

12. CHANGES IN MECHANICAL WORK

REFER TO GENERAL AND SPECIAL CONDITIONS.

13. CLAIMS FOR EXTRA COST

REFER TO GENERAL AND SPECIAL CONDITIONS.

14. SURVEY, MEASUREMENTS AND GRADE

A. The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.

B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the contract documents, he shall promptly notify the Engineer and shall not proceed with this work until he has received instructions from the Engineer on the disposition of the work.

15. TEMPORARY USE OF EQUIPMENT

A. The permanent heating and plumbing equipment, when installed, may be used for temporary services, with the consent of the Engineers. Should the permanent systems be used for this purpose the Contractors shall make all temporary connections required at their expense. They shall also make any replacement required due to damage wear and tear, etc., leaving the same in "as new" condition.

B. Permission to use the permanent equipment does not relieve the Contractors from the responsibility for any damages to the building construction and/or equipment which

might result because of its use.

C. A pre-start-up conference shall be held with the Architect, Owner, General Contractor and the Mechanical Contractor. Equipment shall not be started until after this meeting.

D. During all phases of construction:

(2) Heat Pump Units:

a. Provide all filters required during construction to keep units clean. All filters used during construction shall be Merv 8. Change as often as necessary - minimum.

b. At substantial completion of the project the entire unit shall be cleaned to present a like “new” unit for the Owner and all filters shall be replaced with new.

(3) Outside Air Units:

a. These units shall not be used for temporary heating and cooling by the Contractor. They shall, however, be made operational, tested, etc. as specified during construction by the Contractor.

b. At substantial completion of the project the entire unit shall be cleaned to present a like “new” unit for the Owner and all filters shall be replaced with new.

16. TEMPORARY SERVICES

A. The Contractor shall arrange any temporary water, electrical and other services which he may require to accomplish his work. Refer also to General and Special Conditions.

17. RECORD DRAWINGS

A. The Contractor shall insure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to insure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose. Deliver these record drawings electronically in AutoCAD 2000 format along with the hand marked field set to the Engineer. Electronic bid drawings will be furnished to the Contractor for his use.

18. MATERIALS AND WORKMANSHIP

A. All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Proposer shall determine that the materials

and/or equipment he proposes to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be necessary to remove and replace walls, floors and/or ceilings and this work shall be the responsibility of the Contractor. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement of filters, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Insure, through coordination, that no other Contractor seals off access to space required for equipment, materials, etc.

B. Materials and equipment, where applicable, shall bear Underwriters' Laboratories label where such a standard has been established.

C. Use extreme care in the selection of equipment and its installation to insure that noise and vibration are kept at a minimum. The Engineer's determination shall be final and corrections to such discrepancies shall be made at the cost of the Contractor.

19. COOPERATION AND COORDINATION WITH OTHER TRADES

A. The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.

B. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 1/4” = 1'-0”, clearly indicating how his work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. He shall make the necessary changes in his work to correct the condition without extra charge.

C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

20. QUALIFICATIONS OF WORKMEN

A. All mechanical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workman shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of Architect, Contractor, etc.

B. All plumbing work shall be accomplished by Journeymen Plumbers under the direct supervision of a Master Plumber as defined and clarified under International Plumbing Regulations and Code. Proof and Certification may be requested by the Engineer.

C. All sheet metal, insulation and pipe fitting work shall be installed by workmen normally engaged or employed in these respective trades, except where only small amounts of such work are required and are within the competency of workmen directly employed by the Contractor involved.

D. All automatic control systems shall be installed by workmen normally engaged or employed in this type work.

E. All special systems (Automatic Sprinkler Equipment, etc.) shall be installed only by workmen normally engaged in such services. Exception to this specification may only be made in writing by the Engineer.

F. All electrical work shall be installed only by competent workmen under direct supervision of a fully qualified Electrician.

21. CONDUCT OF WORKMEN

A. The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workman to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

22. PROTECTION OF MATERIALS AND EQUIPMENT

A. The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from physical, sun, and weather damage during the construction period. Such protection shall be by a means acceptable to the manufacturer and Engineer. All rough-in soil, waste, vent and storm piping, ductwork, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged, stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at his own expense.

23. SCAFFOLDING, RIGGING AND HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

24. BROKEN LINES AND PROTECTION AGAINST FREEZING

A. No conduits, piping, troughs, etc. carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping. All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. If in doubt, contact the Engineer. Do not install piping across or near openings to the outside whether they are carrying static or moving fluids or not. Special Note: Insulation on piping does not necessarily insure that freezing will not occur.

25. CLEANING

A. The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish and debris caused by his operations; and at the completion of the work, shall remove all rubbish, debris, all of his tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.

B. After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.

26. CONCRETE WORK

A. The Contractor shall be finally responsible for the provisions of all concrete work required for the installation of any of his systems or equipment. He may, at his option, arrange with the others to provide the work. This option, however, will not relieve the Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Mechanical work shall be 3000 psi minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication AC1-318. Heavy equipment shall not be set on pads for at least seven (7) days after pour. Insert 6-inch steel dowel rods into floors to anchor pads.

B. All mechanical equipment (tanks, heaters, heat pumps, water heaters, softners, pumps, air handling units, etc.) shall be set on a minimum of 4” tall concrete pads. Pads shall be taller where required for condensate traps. All concrete pads shall be complete with all pipe sleeves, anchor bolts, reinforcing steel, concrete, etc. as required. Pads larger than 18” in width shall be reinforced with ½” round bars on 6” centers both ways. Bars shall be approximately 3” above the bottom of the pad. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or

show honeycomb after removing forms, all surfaces shall be rubbed to a smooth surface. Chamfer all square edges one-half inch.

C. In general, concrete pads for equipment shall extend four (4) inches beyond the equipment's base dimensions. Where necessary, extend pads 30 inches beyond base or overall dimensions to allow walking and servicing space.

D. Exterior concrete pads shall be four (4) inches minimum above grade and four (4) inches below grade on a tamped four (4) inch dense grade rock base unless otherwise indicated or specified. Surfaces of all foundations and bases shall have a smooth finish with one-half (1/2) inch chamfer on exposed edges.

E. All exterior below grade concrete structures (utility vaults, grease traps, manholes, etc.) shall be provided with exterior waterproofing. Waterproofing shall be hot-fluid applied rubberized-asphalt waterproofing membrane with elastomeric sheets at edges, corners, and terminations of membrane for continuous watertight construction. Apply in layers and reinforce as required to provide uniform seamless membrane minimum 4mm thickness. Also, seal penetrations into and out of the structure watertight. Provide Link-Seal modular seal or equal.

27. NOISE, VIBRATION OR OSCILLATION

A. All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at his expense.

B. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc. by means of flexible connectors, vibration absorbers, or other approved means. Unitary equipment, such as small room heating units, small exhaust fans, etc., shall be rigidly braced and mounted to wall, floor or ceiling as required and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation. Flush and surface mounted equipment such as diffusers, grilles, etc., shall be gasketed and affixed tightly to their mounting surface.

C. The Contractor shall provide supports for all equipment furnished by him. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineers.

28. ACCESSIBILITY

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.

B. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, etc.

C. The Contractor shall provide access panels for each concealed valve, control damper or other device requiring service as shown on engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work.

29. RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, SURFACES, ETC.

A. The Contractor shall at his expense restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item and shall be to the satisfaction of the Architect and/or Engineer.

30. MAINTENANCE OF EXISTING UTILITIES AND LINES

A. The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that comes within the contract construction site, shall be subject to continuous uninterrupted service with no other exception than the Owner of the utilities permission to interrupt same temporarily.

B. Utilities and lines, where known, are indicated on the drawings. Locations and sizes are approximate. Prior to any excavation being performed, the Contractor shall ascertain that no utilities or lines are endangered by new excavation. Exercise extreme caution in all excavation work.

C. If utilities or lines occur in the earth within the construction site, the Contractor shall probe and locate the lines prior to machine excavation or blasting in the respective area.

D. Cutting into existing utilities and services where required shall be done in coordination with and only at times designated by the Owner of the utility.

E. The Contractor shall repair to the satisfaction of the Engineer, any surfaces or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

F. Machine excavation shall not be permitted with ten feet of electrical lines or lines carrying combustible and/or explosive materials. Hand excavate only.

G. Protect all new or existing lines from damage by traffic, etc. during construction. Repairs or replacement of such damage shall be at the sole expense of the party responsible.

31. SMOKE AND FIRE PROOFING

A. The Contractor shall fire and smoke stop all openings made in fire or smoke rated walls, chases, ceilings and floors in accord with the KBC. Patch all openings around ductwork and piping with appropriate type material to stop smoke at smoke walls and provide commensurate fire rating at fire walls, floors, ceilings, roofs, etc. Back boxes in rated walls shall be a minimum distance apart as allowed by code to maintain the rating. If closer provide rated box or fireproofing in code approved manner.

32. MOTORS

A. Motors shall be built in accordance with the latest standards of NEMA and as specified. Motors shall be tested in accordance with standards of A.S.A. C50, conforming to this and all applicable standards for insulation resistance and dielectric strength.

B. Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box, and N.E.C. required disconnecting means as specified or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.

C. The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. See Division 26 of Specifications for further requirements related to installation of motors.

33. CUTTING AND PATCHING

A. The Contractor shall provide his own cutting and patching necessary to install his work. Patching shall match adjacent surfaces and shall be to the satisfaction of the Architect and Engineer.

B. No structural members shall be cut without the approval of the Engineer and all such cutting shall be done in a manner directed by him.

C. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

34. CURBS, PLATES, ESCUTCHEONS & AIR TIGHT PENETRATIONS

A. In all areas where ducts are exposed and ducts pass thru floors, the opening shall be surrounded by a 4 inch high by 3 inch wide concrete curb.

B. Escutcheon plates shall be provided for all pipes and conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

C. Seal all duct, pipe, conduit, etc., penetrations through walls and floors air tight. If wall or floor assembly is rated then use similarly rated sealing method.

35. WEATHERPROOFING

A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.

36. OPERATING INSTRUCTIONS, MAINTENANCE MANUALS AND PARTS LISTS

A. Upon completion of all work tests, the Contractor shall instruct the Owner or his representative(s) fully in the operations, adjustment and maintenance of all equipment furnished. The time and a list of representatives required to be present will be as directed by the Engineer. Turn over all special wrenches, keys, etc., to the owner at this time.

B. The Contractor shall furnish three (3) complete bound sets for delivery to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs alone will not be acceptable for operating and maintenance instructions.

C. The Contractor, in the instructions, shall include a preventive maintenance schedule for the principal items of equipment furnished under this contract and a detailed, parts list and the name and address of the nearest source of supply.

D. The Contractor shall frame under Lexan in the main mechanical room all piping diagrams.

37. PAINTING

A. In general, all finish painting shall be accomplished under the Painting Section of the specifications by the Contractor; however, unless otherwise specified under other sections of these specifications, the following items shall be painted:

(1) All exposed piping, valve bodies and fittings (bare and insulated), including hangers, platforms, etc.

(2) All mechanical equipment not factory finished. Aluminum and stainless steel equipment, motors, identification plates, tags, etc. shall not be painted. All rust and foreign matter shall be thoroughly removed from surfaces prior to painting. All baked enamel factory finish of equipment which may have been scratched or chipped shall be touched up with the proper paint as recommended and supplied by the manufacturer.

(3) All ductwork exposed in finished areas (bare and insulated), all grilles, diffusers, etc. not factory finished. Paint the inside surfaces of all interior duct surfaces visible from any register, grille or diffuser opening on all jobs; surfaces shall receive one (1) prime coat of Rustoleum 1225 red "galvinoleum" or other approved equivalent primer and rust inhibitor and one (1) coat of Rustoleum 1579 jet black "Speedy Dry" enamel or approved equivalent applied in accordance with the manufacturer's recommendations.

(4) All insulated piping, ductwork and equipment shall be properly prepared for painting by the Contractor where mechanical items are to be painted. In the case of externally insulated duct and pipe, the Contractor shall provide 6 oz. canvas jacket with fire retardant lagging. The jacket shall be allowed to dry properly before applying paint to avoid shrinking after painting and exposing unpainted surfaces. The Contractor, at his option, may provide double wall ductwork in lieu of externally insulated ductwork with canvas jacket and lagging.

38. ELECTRICAL CONNECTIONS

A. The Contractor shall furnish and install all (1) temperature control wiring; (2) equipment control wiring and (3) interlock wiring. The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring thru starters, and shall furnish and install all required starters not factory mounted on equipment.

B. The Contractor shall, regardless of voltage, furnish and install all temperature control wiring and all associated interlock wiring, all equipment control wiring and conduit for the equipment that the Contractor furnishes. He may, at his option, employ at his own expense, the Electrical Contractor to accomplish this work.

C. After all circuits are energized and completed, the Contractor shall be responsible for all power wiring, and all control wiring shall be the responsibility of the Contractor. Motors and equipment shall be provided for current characteristics as shown on the drawings.

D. The Contractor shall furnish motor starters of the type and size required by the manufacturer for all equipment provided by him, where such starters are necessary. Starters shall have overloads for each phase.

39. FINAL CONNECTIONS TO EQUIPMENT

A. The Contractor shall finally connect to mechanical services, any terminal equipment, appliances, etc., provided under this and other divisions of the work. Such connections shall be made in strict accord with current codes, safety regulations and the equipment manufacturer's recommendations. If in doubt, contact the Engineers prior to installation.

40. REQUIRED CLEARANCE FOR ELECTRICAL EQUIPMENT

A. The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping, ductwork, etc., in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost.

41. INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

42. HAZARDOUS MATERIALS

A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, insure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.

D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

43. ABOVE-CEILING AND FINAL PUNCH LISTS

A. The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project:

(1) For review of above-ceiling work that will be concealed by tile or other materials well before substantial completion.
(2) For review of all other work as the project nears substantial completion.

B. When all work from the Contractor's punch list is complete at each of these stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.

C. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor at a rate of $125.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.

Phone: (859) 253-0892

The following is CMTA's guide for Division 20-25 required information relative to the Schedule of Values. Please utilize all items that pertain to this project and add any specialized system as required. A thorough and detailed schedule of values will allow for fair and equitable Pay Application approval and minimize any discrepancies as to the status of the job.

DIVISION 20-25 – MECHANICAL Field Representative: Project Engineer:			
Description of Work	Scheduled Value	Labor	Material
Shop Drawings			
Mobilization/Permits			
Geothermal Horizontal Piping			
Geothermal Wells, Vertical pipe and grout			
Plumbing Underslab			
Sanitary Above Slab Rough-in			
Plumbing Fixtures			
Plumbing Inspections			
Sprinkler Plan Submittals			
Fire Protection Exterior			
Fire Protection Vault			
Fire Protection Interior			
Storm Piping Interior			

Plumbing Shop Drawings			
Mechanical Shop Drawings			
Domestic Water Piping			
Domestic Water Insulation			
Hydronic Piping			
HVAC Sheet Metal			
Heat Pumps			
Outside Air Unit			
VAV Boxes			
Pumps & Assoc. Equipment			
Grilles & Diffusers			
Insulation			
Controls			
Air and Water Balance			
Chemical Treatment			
Factory Start-Up Reports			
Owner Training			
Record Drawings			
O & M Manuals			
Punchlist/Closeout			
Controls Check-out			

END OF SECTION 20 01 00

SECTION 20 02 00 - SCOPE OF THE MECHANICAL WORK

1. GENERAL

A. The Mechanical work for this Contract shall include all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, place in service and deliver to the Owner the complete mechanical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not necessarily limited to the following:

(1) Complete domestic water service finally connected to the local domestic water system. Owner shall be responsible for all domestic water tap fees. The contractor shall not include domestic water tap fees in the bid.

(2) Complete sanitary sewer system connected to the local system.

(3) Complete interior storm drainage system connected to site system.

(4) Interior domestic hot, cold and recirculating hot water system.

(5) Interior soil, waste and vent systems.

(6) Roof drainage system.

(7) All plumbing equipment, fixtures and fittings.

(8) 100% automatic sprinkler system.

(9) All mechanical exhaust systems.

(10) All insulation associated with mechanical systems.

(11) Condensate drainage systems.

(12) Complete heating, ventilation and air conditioning systems.

(13) Final connection of all mechanical equipment furnished by others (e.g., kitchen equipment).

(14) Complete balancing of air and water systems.

(15) All applicable services and work specified in Section 200100; General Provisions - Mechanical.

(16) All specified or required control work.

(17) Provide all required motor starters, etc. not provided under the electrical sections.

(18) One year guarantee of all mechanical equipment, materials, and workmanship.

(19) Thorough instruction of the owner's maintenance personnel in the operation and maintenance of all mechanical equipment.

(20) Thorough coordination of the installation of all piping, equipment and any other material with other trades to insure that no conflict in installation.

(21) Approved supervision of the mechanical work.

(22) Excavation, backfilling, cutting, patching, sleeving, concrete work, etc., required to construct the mechanical systems.

(23) Prior to submitting a bid, the Contractor shall contact all serving utility companies to determine exactly what each utility company will provide and exactly what is required of the Contractor and shall include such requirements in his base bid.

(24) Procurement of all required permits and inspections, including fees for all permits and inspection services and submission of final certificates of inspection to the Engineers (Plumbing, HVAC, etc.).

(25) All necessary coordination with water, and sewer utility companies, etc., to insure that work, connections, etc., that they are to provide is accomplished.

(26) Factory start-up of all major equipment (including terminal HVAC equipment) and submission of associated factory start-up reports to the Engineer.

END OF SECTION 20 02 00

SECTION 20 03 00 - SHOP DRAWINGS, DESCRIPTIVE LITERATURE, MAINTENANCE MANUALS, PARTS LISTS, SPECIAL KEYS & TOOLS

1. GENERAL

A. The Contractor's attention is directed also to the General and Special Conditions and Section 200100 - General Provisions - Mechanical as well as to all other Contract Documents as they may apply to his work.

B. The Contractor shall prepare and submit to the Engineer, through the General Contractor and the Architect (where applicable) within thirty (30) days after the date of the Contract, a minimum of seven (7) copies of all shop drawings, certified equipment drawings, installation, operating and maintenance instructions, samples, wiring diagrams, etc. on all items of equipment specified hereinafter.

C. Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.

D. All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the General Contractor and the Architect (if applicable) to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.

E. It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

F. The Engineers review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for: adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project. Any items that differ from the Drawings or Specifications shall be flagged by the Contractor so the Engineer will be sure to see the item. Do not rely on the Engineer to “catch” items that do not comply with the Drawings or Specifications. The Contractor is responsible for meeting the Drawings and Specification requirements, regardless of whether or not something does not get caught by the Contractor or Engineer during shop drawing reviews.

G. Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor.

It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. to the equipment.

H. If the Contractor fails to comply with the requirements set forth above, the Engineer shall have the option of selecting any or all items listed in the Specifications or on the drawings; and the Contractor shall be required to furnish all materials in accordance with this list.

I. Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors. Color samples shall be furnished with the shop drawing submission for such equipment.

J. Shop Drawing Submittals

(1) All submittals for HVAC equipment shall include all information specified. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.

(2) All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule.

(3) All items submitted shall be designated with the same identifying tag as specified on each sheet.

(4) Any submittals received in an unorganized manner without options listed and with incomplete data will be returned for resubmittal.

2. SHOP DRAWINGS

Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:

Duct & pipe Insulation
Hydronic Specialties
Chemical Treatment System
Pumps
Heat Pumps
Outside Air Units
VAV Boxes
Boilers
Cooling Tower
Heat Exchanger
Water Heater
Plumbing Fixtures

Fans
Fire Protection
Geothermal Grout, Piping
Plumbing Fixtures
Plumbing Equipment
Controls
RGDs
Louvers

SPECIAL NOTES:

(1) Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three (3) complete copies of operation and maintenance instructions and parts lists for each item marked (1) above. These documents shall include at least:

(a) Detailed operating instructions
(b) Detailed maintenance instructions including preventive maintenance schedules.
(c) Addresses and phone numbers indicating where parts may be purchased.

(2) Shop drawings for the Control Systems shall include detailed, scaled plans and schematic diagrams indicating the function and operation of the system.

(3) Shop drawings for the Building Fire Protection System shall be prepared and stamped by a Certified Contractor and shall meet the criteria of the Department of Housing, Buildings and Construction and submitted to the Engineer. After the Engineer's review, they shall be submitted by the Contractor to the proper state authorities along with the required State review fee.

(4) The Contractor shall submit shop drawings for the kitchen hood system(s) along with all required supporting documentation and review fees to the Department of Housing, Buildings and Construction and receive approval prior to submittal to the Engineers.

(5) The Contractor shall submit Material Safety Data sheets for all chemical treatment and anti-freeze solutions.

3. SPECIAL WRENCHES, TOOLS, ETC.

(1) The Contractor shall furnish, along with equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed under the Contract. Wrenches shall include necessary keys, handles and operators for valves, cocks, hydrants, etc. A reasonable number of each shall be furnished.

4. BALANCE REPORTS

A. Upon substantial completion of the project, the Contractor shall submit to the Engineers an electronic copy of the Certified Air and Hydronic Balance Report.

END OF SECTION 20 03 00

SECTION 20 05 00 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

1. COORDINATION

   A. The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural and Structural drawings, to the end that complete coordination between trades will be affected. Special attention shall be given to the points where ducts or piping must cross other ducts or piping, where lighting fixtures must be recessed in ceilings, and where ducts, piping and conduit must fur into walls, soffits, columns, etc. It shall be the responsibility of the Contractor to leave the necessary room for other trades. No extra compensation will be allowed to cover the cost of removing piping, conduit, ducts, etc., or equipment found encroaching on space required by others.

   B. The Contractor shall be responsible for coordination with the Electrical trade to insure that he has made provision for connections, operational switches, disconnect switches, fused disconnects, etc. for electrically operated equipment provided under this division of the specifications, or called for on the plans.

   C. If any discrepancies occur between accompanying drawings and these specifications and drawings and specifications covering other Contracts, each trade shall report such discrepancies to the Architect far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of piping, ductwork, conduit, and equipment not installed in accordance with the above instructions, and which interfered with work and equipment of other trades.

   D. In all areas where air diffusers and lighting fixtures are to be installed, the Contractor shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangements.

2. INTERFACING

   The Contractor shall insure that coordination is affected relative to interfacing of systems. Some interface points are (but not necessarily all):

   A. Connection of Domestic Water System to water service mains.

   B. Connection of Fire Protection System to domestic water service.

   C. Connection of Sanitary sewer house line to municipal service.

   D. Connection of Storm Drainage System to municipal system.

   E. Connection of all controls to equipment.

F. Electrical power connections to electrically operated (or controlled) equipment.

3. CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

A. The Contractor shall make all connections to equipment furnished by others, or relocated from the existing structure, whenever such equipment is shown on any part of the drawings or mentioned in any part of the Specifications, unless otherwise specifically specified hereinafter.

B. Supervision to assure proper functioning and operation shall be provided by the Contractor.

C. Items indicated on the drawings as rough-in only (RIO) will be connected by others. The Contractor shall be responsible for rough-in provisions only.

D. For items furnished by others, relocated, or RIO, the Contractor shall obtain from the supplier or shall field determine as appropriate, the exact rough-in locations and connection sizes for the referenced equipment.

E. The Contractor shall be responsible for coordinating to determine any and all final connections that he is to make to equipment furnished by others.

END OF SECTION 20 05 00

SECTION 20 11 00 - SLEEVING, CUTTING, PATCHING AND REPAIRING

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

   B. The Contractor shall be responsible for all openings, sleeves, trenches, etc., that he may require in floors, roofs, ceilings, walls, etc., and shall coordinate all such work with the General Contractor and all other trades. Coordinate with the General Contractor, any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the Contractor.

   C. The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for piping, ductwork, conduit, etc., to go through; however, when this is not done, the Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Engineer. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at is own expense.

   D. The Contractor shall notify other trades in due time where he will require openings or chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.

   E. The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements shall be promptly and properly made good to the satisfaction of the Engineer.

   F. All work improperly done or not done at all as required by the Mechanical Trades in this section, will be performed by the Contractor at the direction of the trade whose work is affected.

2. SLEEVES, PLATES AND ESCUTCHEONS

   A. The Contractor shall provide and locate all sleeves and inserts required for his work before the floors and surface being penetrated are built, otherwise the Contractor shall core drill for pipes where sleeves and inserts were not installed, or where incorrectly located. Core drilling is the only acceptable alternative to sleeves. Do not chisel openings. Where

sleeves are placed in exterior walls or in slabs on grade, the space between the pipe or conduit and the sleeves shall be made completely and permanently water tight.

B. Pipe that penetrates fire and/or smoke rated assemblies shall have sleeves installed as required by the manufacturer of the rating seal used.

C. At all other locations either pipe sleeves or core drilled openings are acceptable.

D. Where thermal expansion does not occur, the wall may be sealed tight to the pipe or insulation.

E. Insulation, that requires a vapor barrier (i.e., cold water or refrigerant piping, etc.), must be continuous through the sleeve/cored hole. For other piping, insulation may stop on either side of the sleeve.

F. Sleeves shall be constructed of 24 gauge galvanized sheet steel with lock seam joints or Schedule 40 pipe. Sleeves in floors shall extend 1" above finished floor level.

G. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction.

H. In all areas where ducts are exposed and ducts pass thru floors, the opening shall be surrounded by a 4 inch high by 3 inch wide concrete curb.

I. Escutcheon plates shall be provided for all pipes and conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

3. CUTTING

A. All rectangular or special shaped openings in plaster, stucco or similar materials, including gypsum board, shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirement is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for grilles, diffusers, lighting fixtures, etc.

B. Mechanical, plumbing, and fire protection contractors shall coordinate all openings in new and existing masonry walls with the General Contractor; and, unless otherwise indicated on the Architectural drawings, provide lintels for all openings required for the work (Louvers, wall boxes, exhaust fans, etc.). Lintels shall be sized as follows:

(1) New Openings under 48" in width: Provide one 3-1/2"x3-1/2"x3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on either side.

(2) New Openings 48" to 96" in width: Provide one 3-1/2"x6"x3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on either side.

(3) New Openings over 96" in width: Consult the Project Structural Engineer.

C. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Engineer.

D. Pipe openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

E. Openings in metal building walls shall be made in strict accord with building suppliers recommendations.

4. PATCHING AND REPAIRING

A. Patching and repairing made necessary by work performed under this division shall be included as a part of the work and shall be done by skilled mechanics of the trade or trades for work cut or damaged, in strict accordance with the provisions herein before specified for work of like type to match adjacent surfaces and in a manner acceptable to the Engineer.

B. Where portions of existing lawns, shrubs, paving, etc. are disturbed for installation of work of this Division, such items shall be repaired and/or replaced to the satisfaction of the Engineer.

C. Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the space around such conduit, duct, pipe, etc., shall be tightly filled with an approved non-combustible fire insulating material satisfactory to maintain the rating integrity of the wall, floor or ceilings affected.

D. Where ducts penetrate fire rated assemblies, fire dampers shall be provided with an appropriate access door.

E. Piping passing through floors, ceilings and walls in finished areas, unless otherwise specified, shall be fitted with chrome plated brass escutcheons of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe around which it is installed.

F. Stainless steel collars shall be provided around all ducts, large pipes, etc., at all wall penetrations; both sides.

G. Where ducts, pipes, and conduits pass through interior or exterior walls, the wall openings shall be sealed air tight. This shall include sealing on both sides of the wall to insure air does not enter or exit the wall cavity. This is especially critical on exterior walls where the wall cavity may be vented to the exterior.

H. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

END OF SECTION 20 11 00

SECTION 20 12 00 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

   B. The Contractor shall include all excavating, filling, grading, and related items required to complete his work as shown on the drawings and specified herein or as required to complete, connect and place all mechanical systems in satisfactory operation.

   C. Unless otherwise shown or required, provide separate trenches for sewers, water lines and other underground raceways, with a minimum of 10 feet measured from outside diameter between pipes. In locations, such as close to buildings where separate trenches for sewers and water lines are impractical, lay the water pipe on a solid shelf at least 2'-0" above the top of the sewer and 2-0" to the side. Electric and fuel lines shall always be placed in a separate trench. All exterior lines shall have a minimum earth cover of thirty (30) inches to top of pipe, unless otherwise indicated.

   D. Water lines crossing under sewer lines, or crossing less than 2 feet above sewer lines, must be encased for a distance not less than 5 feet on either side of the point of crossover.

2. SUBSURFACE DATA

   A. Materials to be excavated shall be unclassified, and shall include earth, rock, or any other material encountered in the excavating to the depth and extent indicated on the drawings and specified herein. No adjustment in the Contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in the excavating. This paragraph is written to include the removal of all rock with no extras, whether rock is indicated or not.

3. BENCH MARKS AND MONUMENTS

   A. Maintain carefully all bench marks, monuments and other reference points. If disturbed or destroyed, replace as directed.

4. EXCAVATION

   A. Excavate trenches of sufficient width for proper installation of the work. When the depth of backfill over sewer pipe exceeds 10 feet, keep the trench at the level of the top of the pipe as narrow as practicable. Trench excavation for piping eight inches and smaller shall not exceed thirty inch width for exterior lines and twenty-four inch width for interior lines.

B. Sheet and brace trenches as necessary to protect workmen and adjacent structures. Comply with local regulations or, in the absence thereof, with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc., and current OSHA Standards. Do not remove sheeting until trench is backfilled sufficiently to protect pipe and prevent injurious caving. Where removal of sheeting and/or bracing is hazardous, leave in place. Cut off such sheeting not to be removed at least 3 feet below finished grade.

C. Rules and regulations governing the respective utilities shall be observed in executing all work under this heading. Active utilities discovered in the course of excavation shall be protected or relocated in accordance with written instructions from the Engineer. Inactive and abandoned utilities encountered in trenching operations shall be removed and abandoned with ends plugged or capped in accord with current codes and safe practice. If in doubt, contact Engineers. Machine excavation shall not be allowed within ten (10) feet of existing electric lines or lines carrying combustible materials. Use only hand tools.

D. The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted unless authorized in writing by the Engineer. Any damage to existing structures, exterior services, or rock intended for bearing, shall be corrected at the Contractor's expense.

E. Perform final grading of trench bottoms by hand tools; carry machine excavation only to such depth that soil bearing for pipes and raceways will not be disturbed. Grade the bottom of trenches evenly to insure uniform bearing for all piping and raceways. Cut bell holes as necessary for joints and jointmaking. Except as hereinafter specified, bottom of trenches for bell and spigot pipe, flanged pipe, etc. shall be shaped to the lower quadrant of pipe with additional excavation for bell or flange. Piping installed where it rests on bell, or flange and/or is supported with blocks or wedges will not be accepted.

F. Keep trenches free from water while construction therein is in progress. Under no circumstances lay pipe or appurtenances in water. Pump or bail water from bell holes to permit proper jointing of pipe. Any water pumping from this Contractor's trenches which is required during construction, shall be included in this Contract.

G. In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, utility lines, large trees to remain, etc. The Contractors shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage or any other damage incurred in the course of excavation shall be borne by the responsible Contractor.

H. Use surveyor's level to establish elevations and grades.

I. The Contractor shall accept the site as he finds it and remove all trash, rubbish and material from the site prior to starting excavation of his work.

J. The Contractor shall provide and maintain barricades and temporary bridges around excavations as required for safety. Temporary bridges shall be provided where excavations cross paved areas and walks. The Contractor shall maintain these bridges in a safe and passable condition for all traffic until removal. Refer to OSHA Standards for such installations and comply with same in all details.

K. Pay particular attention to existing utilities and lines to avoid damage. The locations of existing lines which are indicated on the plans were taken unconfirmed from drawings prepared for previous construction and locations are approximate only. Also, certain water, gas, electric, storm and sanitary sewer lines and other underground appurtenances, active or abandoned, may not appear on the drawings. It shall be each Mechanical Contractor's responsibility to ascertain the location of all lines and excavate with caution in their area.

5. BACKFILL AND SURFACE REPAIR

A. Backfilling for mechanical work shall include all trenches, manhole pits, storage tank pits, and/or any other earth and/or rock openings which are excavated under this Contract. Backfilling shall be carefully performed and the surface restored to its original level to receive new finish. Wherever trenches and earth openings have not been properly filled and/or settlement occurs, they shall be re-excavated, re-filled and properly compacted, smoothed off and finally made to conform to the level of the original ground surface.

B. Unless otherwise indicated or specified, all piping shall be bedded on four (4) inches minimum of compacted naturally or artificially graded mixture of crushed gravel, crushed stone, or crushed sand with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve on undisturbed soil excavated as described hereinbefore. Install tracer wire above pipe. Cover the pipe with twelve (12) inches of compacted backfill to prevent settlement above and around the new pipe. The backfill shall be naturally or artificially graded mixture of crushed gravel, crushed stone, or crushed sand with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve. Prior to placing this second level of backfill, apply all required coatings and coverings to pipe, apply required tests and check the grading of the pipe to insure that it is correct and that the pipe is free of swags, bows or bends. Also check lines for leaks at this point and repair as required. Once all of the preceding is accomplished, continue backfill with clean, debris and rock free earth tamped at six (6) inch intervals. Finish the backfill as specified following. Note: Water settling of backfill will be permitted only as an aid to mechanical compacting.

(1) When running any type of pipe below a footer, parallel or perpendicular to the footer, the area underneath the footer and in the zone of influence shall be backfilled with cementitious flowable fill. The zone of influence is the area within a 45 degree angle projecting down from the bottom edge of footers on all sides of the footer. Where PVC piping is used within flowable fill, the pipe shall be isolated from the fill by a layer of heavy duty felt paper or cast iron piping may be used

without a barrier. Piping installed in trenches backfilled with flowable fill shall be anchored to the soil below prior to backfilling.

C. Backfill beneath areas to be seeded or sodded within six (6) inches of finished grade. The remaining six (6) inches shall be backfilled with clean top soil.

D. Backfill beneath paved areas, walks, etc. shall be brought to proper grade to receive the sub-base and paving. No paving shall be placed on uncompacted fill or unstable soil.

E. Wherever, in the opinion of the Engineer, the soil at or below the requisite pipe grade is unsuitable for supporting piping, special support shall be provided as directed by the Engineer.

F. Unsuitable material and surplus excavated material not required for backfill shall be removed from the site. The location of dump and length of haul shall be the affected Contractor's responsibility.

G. Provide and place any additional fill material from off the site as may be required for backfill. Fill obtained from off site shall be of kind and quality as specified for backfill and the source approved by the Engineer and shall be brought to the site by the Contractor requiring the fill.

H. In the absence (if not specified or indicated elsewhere in the drawings or specifications to be done by others) of such work by others, the Contractor shall lay new sod over his excavation work. Level, compress and water in accord with sound sodding practice.

I. When running any type of piping below a footer or in the zone of influence the piping shall be backfilled with cementitious flowable fill. The zone of influence is the area under the footer within a 45 degree angle projecting down from the bottom edge of the footer on all sides of the footer. Additionally, grease traps, manholes, vaults, and other underground structures shall be held away from building walls far enough to be outside of the zone of influence.

J. Warning Tape and Tracer Wire

Provide a yellow and black plastic tape in all trenches 6" above the buried utility that identifies the utility about to be encountered. For non-metallic pipe a #12 copper wire shall also be laid in the trench to aid in future location of the piping. A foil faced warning tape may be used in lieu of the plastic tape and wire.

K. All manholes, vaults, and similar underground structures shall have the top elevation set flush with finished grade unless specifically noted otherwise.

6. MINIMUM DEPTHS OF BURY (TO TOP OF PIPE)

In the absence of other indication, the following shall be the minimum depth of bury of exterior utility lines. (Check drawings for variations).

A. Domestic Water Lines .....36 inches.

B. Fire Protection Lines.....42 inches.

C. Geothermal Lines .....48 inches.

D. Storm Lines .....20 inches.

E. Sanitary Lines (Exterior) .....36 inches.

END OF SECTION 20 12 00

SECTION 20 13 00 - PIPE, PIPE FITTINGS AND PIPE SUPPORT

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. When a pipe size is not indicated, the Contractor shall request the pipe size from the Engineers. All piping shall be installed straight and true, parallel or perpendicular to the building construction. Piping shall be installed so as to allow for expansion without damage to the building finishes, structure, pipe, equipment, etc., use offsets, U-bends or expansion joints as required. Where a section of piping is not indicated but is obviously required for completion of the system, the Contractor shall provide same at no additional cost to the project. No mitered joints or field fabricated pipe bends shall be accepted. Pipe shall clear all windows, doors, louvers and other building openings.

C. All pipe shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze type hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes shall not be permitted. Spacing of pipe supports shall not exceed eight feet for pipes up to 1-1/4 inches and ten feet on all other piping. Small vertical pipes (1 inch and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants. Insulated piping shall be supported on a rigid insulation block at each hanger so as to prevent crushing of insulation by hangers. Hangers shall pass completely around the insulation jacket and a steel protective saddle shall be applied to prevent compression of the insulation. (Refer to Specifications Section entitled INSULATION-MECHANICAL).

D. Where piping rests directly on a hanger, clip, bracket or other means of support, the support element shall be of the same material as the pipe, (e.g., copper to copper, ferrous to ferrous, etc.) or shall be electrically isolated one from the other so as to prevent pipe damage by electrolysis. Pay particular attention and do not allow copper pipe to rest on ferrous structural members, equipment, etc. without electrolytic isolation.

E. In general, piping shall be installed concealed except in Mechanical, Janitor Rooms, etc. unless otherwise indicated, and shall be installed underground or beneath concrete slabs only where indicated. All lines at ceilings shall be held as high as possible and shall run so as to avoid conflicts with other trades, and to facilitate the Owner's use and maintenance. Location of pipe in interior partitions shall be carefully coordinated with whoever will construct the partitions after the piping is in place. Where exposed risers occur they shall be kept as close to walls as possible.

F. Installation of pipe shall be in such a manner as to provide complete drainage of the system toward the source. Drain valves shall be provided at all drainage points on pipes. Drain valves shall be 1/2" size gate type with 3/4" hose thread end and vacuum breaker. Label each drain valve.

G. Underfloor Piping:

(1) All piping installed below a floor on grade shall be supported from the slab on centers noted above.

(2) Pipe hangers shall be placed under piping and those hanger upper portions tied to re-steel in slab, then concrete slabs poured around hangers.

H. All hot and cold water piping shall be kept a sufficient distance apart so as to prevent heat transfer between them. Cold water piping shall also be kept apart from refrigerant hot gas lines.

I. Piping carrying water or other fluids subject to freezing shall not be installed in locations subject to freezing; if in doubt, consult Engineer.

J. Piping for all drainage systems shall be installed to permit flow, trapping, and venting in accord with current codes and sound practice.

K. All cast iron soil pipe and fittings shall be coated inside and out with coal tar varnish.

L. Non-metallic piping shall be installed in strict accordance with the manufacturer's instructions.

M. Nipples shall be of the same material, composition and weight classification as pipe with which installed.

N. Where piping is not indicated on the plans, but is obviously or apparently required, contact the Engineers prior to submission of a bid proposal.

O. Pay particular attention to conflict of piping with other work. Do not install until conflict is resolved. If necessary, contact Engineers.

P. Piping materials in each system shall, to the extent practicable, be of the same material. Frequent changes of material (for example, from copper to steel) shall be avoided and in no case shall be accomplished without use of insulating unions and permission of the Engineers.

Q. Apply approved pipe dope (for service intended) to all male threaded joints.

R. High points of closed loop systems shall have manual or automatic air vents as indicated or required unless automatic air vents are specifically indicated. Pipe to suitable drainage point.

S. All piping shall be capped or plugged during erection as required to keep clean and debris and moisture free.

T. The entire domestic hot, cold and recirculating hot water piping system shall be sterilized in strict accord with requirements of the Department of Health Codes, Rules and Regulations for the State which the work is being accomplished in.

U. Provide expansion joints where shown on the plans and where required by good practice. Expansion joints shall be guided and anchored in accordance with the recommendations of the Expansion Joint Manufacturer's Association.

V. Where plastic pipe penetrates a fire rated assembly, it shall be replaced with a metal threaded adapter and a metal pipe per code.

W. Some spaces in this building plenums. Do not install PVC or HDPE in plenums.

X. Where piping penetrates interior or exterior walls, the wall shall be sealed air tight. Refer to the sleeving, cutting, patching and repairing section of the specifications for additional requirements.

Y. Provide thrust blocks on all storm, sanitary, water, etc., and any other piping subject to hammering. Thrust blocks shall be provided at all turns.

Z. All piping to hydronic coils shall be full size all the way to the coil connection on the unit. If control valve is smaller than pipe size indicated, transition immediately before and after control valve. Also, if coil connection at unit is a different size than the branch pipe size indicated, provide transition at coil connection to unit. On 3-way valve applications, the coil bypass pipe shall be full size.

AA. Provide check valves on individual hot and cold water supplies to each mixing valve (including each sensor style faucet, safety shower, mop sink, etc.) and each showerhead with a diverter valve (including all ADA showers). This requirement shall not be satisfied by mixing valves or fixtures with internal check valves. Independent external check valves are required.

2. UNIONS AND FLANGES AND WELDED TEES

A. Screwed unions, soldered unions or bolted flanges shall be provided as required to permit removal of equipment, valves and piping accessories from the piping system. Keep adequate clearances for coil removal, rodding, tube replacement, motor lubrication, filter replacement, etc. Flanged joints shall be assembled with appropriate flanges, gaskets and bolting. Gaskets for steam piping systems shall be flexitalic spiral wound type. The

clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system.

B. Dielectric insulating unions or couplings shall be used wherever the adjoining materials being connected are of dissimilar metals such as connections between copper and steel pipe.

C. Tee connections for welded pipe shall be made up with welding fittings. Where the size of the side outlet is such that a different connection technique than on the run is required, a weldolet, sockolet, or threadolet type fitting may be used for the branch in place of reducing tees only where the branch is 2/3 the run size or smaller.

3. SPECIFICATIONS STANDARDS

All piping and material shall be new, made in the United States and shall conform to the following minimum applicable standards:

A. Steel pipe; ASTM A-120, A-53 Grade A, A-53 Grade B.

B. Copper tube; Type K, L, M; ASTM B88-62; Type DWV ASTM B306-62.

C. Cast iron soil pipe; ASA A-40.l and CS 188-59.

D. Cast iron drainage fittings; ASA B16.12.

E. Cast iron screwed fittings; ASA B16.4.

F. Welding fittings; ASA B16.9.

G. Cast brass and wrought copper fittings; ASA B16.18.

H. Cast brass drainage fittings; ASA B16.23.

I. Reinforced concrete pipe; ASTM-C-76-64T.

J. Solder; Handy and Harmon, United Wire and Supply; Air Reduction Co. or equivalent.

K. PVC plastic pipe; ASTM D1785.

L. ABS plastic pipe; ASTM D1788-73.

M. HDPE Pipe; ASTM D3035.

4. PITCH OF PIPING

All piping systems shall be installed so as to drain to a low point. Certain minimum pitches shall be required for this drainage. For proper flow and/or for proper operation, the following pitches shall be required:

A. Interior Soil, Waste and Vent Piping:

1/4 inch per foot in direction of flow where possible but in no case less than 1/8" per foot.

B. Exterior Sanitary Lines:

Not less than one (1) percent fall in direction of flow and no greater than indicated.

C. Roof Leaders:

1/8 inch per foot where possible. Where not possible, run dead level.

D. Condensate Drain Lines From Cooling Equipment:

Not less than 1/4 inch per foot in direction of flow.

E. All Other Lines:

Provide ample pitch to a low point to allow 100 percent drainage of the system.

5. APPLICATIONS

A. General Notes

(1) Where plastic piping penetrates a fire rated assembly, it shall be replaced with a threaded metal adapter and metal pipe or whatever means necessary to maintain the separation rating in accordance with local plumbing and fire codes.

(2) Plastic piping or any materials with a flame and smoke spread rating not approved for plenum use shall not be permitted in supply, return, relief or exhaust plenums.

(3) PVC or plastic piping shall not be used under paving, roads or areas where vehicular traffic is expected.

(4) PVC or plastic piping whether specifically listed or not may not be used in high rise buildings or anywhere else prohibited by code.

B. Fire Protection - Exterior and Interior

Refer to the Fire Protection System section of these specifications.

C. Soil Waste and Vent Piping - General Requirements

(1) Water closet floor flanges and ells shall be cast iron regardless whether PVC piping is allowed or not.

(2) Soil and waste piping serving mechanical rooms, laundries and kitchens shall be cast iron regardless whether PVC piping is allowed or not. Cast iron will also be required at any other location where waste water temperature can exceed 120°F. Cast iron shall extend a minimum of 35' past last waste inlet.

D. Soil, Waste and Vent Piping (Below Slab)

(1) General: Foam core PVC piping is not permitted.

(2) Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the Plumbing Code.

(3) Service weight hubless cast iron with manufacturer's approved bands.

E. Soil, Waste and Vent Piping (Above Slab)

(1) Service weight hubless cast iron pipe with manufacturer's approved bands.

(2) Service weight cast iron hub and spigot piping with lead and oakum joints or compression gasket joints.

(3) Type DWV copper drainage piping with cast bronze drainage pattern fittings with solder joints.

(4) Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the Plumbing code.

F. Soil and Waste Underground Exterior Site Piping - SDR 35 PVC pipe extruded from Type 1, Grade 1 polyvinyl chloride material. PVC pipe shall have a bell type fitting on one end. All joints shall be solvent cement type, made in accordance with the KY Plumbing Code.

G. Roof Leaders/Interior Storm Sewer Piping

(1) Service weight hubless cast iron pipe with manufacturers approved bands.

(2) Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints.

H. Sump Pump Discharge

(1) Type “M” copper with solder joints.

(2) Schedule 40 PVC where piping is not installed in a plenum. All piping exposed on the exterior must be copper.

I. Domestic Cold, Hot and Recirculating Hot Water Piping (Above Slab)

(1) Type "L" hard copper tubing with wrought copper fittings with lead free solder equivalent in performance to 95/5. (Maximum lead content of solder and flux is 2%).

J. Domestic Cold, Hot and Recirculating Hot Water Piping (Below Slab) trap primer piping

Type "K" hard or soft copper tubing with wrought copper fittings and brazed joints. There shall be no joints beneath slabs.

K. Domestic Water Exterior Underground – Schedule 40 PVC pipe, NSF approved for underground domestic cold-water pipe, with solvent weld joints. All piping and joints shall meet the Plumbing Code

L. Hydronic Piping (Heat Pump Systems in Building)

(1) 2" and Smaller: Type "L" hard copper tubing with wrought copper fittings and 95/5 solder.

(2) 2-1/2" and Larger: Schedule 40 black steel pipe with 125# welded or flanged joints. Weldolets may be used for branch line connections to pipe mains. Type "L" hard copper piping with wrought copper fittings and 95/5 solder may be installed.

(3) Schedule 40 Victaulic or approved equivalent mechanical grooved pipe couplings and fittings with 125# rating minimum may be used. Install gaskets as recommended by the manufacturer. Piping system shall be rated for minimum of 220°F water temperature. Mechanical grooved piping may not be used if system water temperature exceeds 220°F.

(4) HDPE – See Geothermal section for material.

a. Victaultic HDPE 905/907 couplings for 2-1/2” and larger interior HDPE heat pump piping is acceptable.

(5) Special Notes:

a. Dielectric unions shall be provided at all connections of dissimilar materials.

b. Copper and steel piping shall not be mixed in the mechanical room.

c. Piping shall meet all State Boiler Code requirements. Pay particular attention to welded pipe requirements for hot water systems.

d. Takeoffs and branch piping to individual coils or heat pumps shall not be connected to the bottom of hydronic mains. Connection to mains shall be at the side of the main. Also refer to details on the drawings.

M. Air Vent Discharge Lines

Type "L" soft copper; wrought copper fittings, 95/5 solder.

N. Refrigerant Piping

ACR copper tubing with forged or wrought copper fittings and silver soldered joints. Solder must have a minimum of 15% silver content.

(1) General Installation Notes:

a. Contact Engineer 24 hours prior to installation of refrigerant lines or evacuation of refrigerant system.

b. Refrigerant lines installation must meet HVAC equipment manufacturer's recommendations.

c. While installing or soldering refrigerant lines, system must continuously be purged with nitrogen.

d. After system is installed, the refrigerant system must be evacuated to 25 microns for eight hours.

O. Condensate Drain Lines

(1) Type "DWV" copper, wrought copper, lead free solder.

(2) Schedule 40 PVC with solvent welded fittings.

P. Water Heater Relief Line

Type "M" copper tubing with sweat fittings and 95/5 solder.

END OF SECTION 20 13 00

SECTION 20 13 20 - GEOTHERMAL (EARTH COUPLED) LOOP PIPING SYSTEM

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

2. INSTALLATION PERSONNEL AND TRAINING REQUIRED

   A. The loop installer must have a current International Ground Source Heat Pump Association (IGSHPA) certification, having completed an IGSHPA training course in the fundamentals of design, installation, and operation of ground source systems, and having passed the IGSHPA certification examination.

   B. Ground heat exchanger fabricators must have completed a heat fusion school in which each participant has performed a heat fusion procedure under direct supervision of a IGSHPA Certified Heat Fusion Technician. The Fusion Technician must be thoroughly familiar with heat fusion procedures, and have had formal training at a heat fusion school under direct supervision of an IGSHPA certified instructor.

   C. Local and state laws, ordinances, and regulations as they pertain to buried pipe systems shall be strictly followed.

3. GROUND HEAT EXCHANGER MATERIALS

   A. Piping shall be virgin polyethylene with a PE 4710 piping formulation and cell classification of 445576C or E per ASTM D 3350. Pressure ratings are at 73.4° F.

   B. 2" and smaller shall be SDR 9. Pressure rating of 255 PSI

   C. 3" and larger shall be SDR 15.5 or Schedule 40. Pressure rating of 135 PSI.

   D. Markings

      (1) Sufficient information shall be permanently marked on the length of the pipe as defined by the appropriate ASTM pipe standard.

      (2) Piping shall also have permanent factory length markings.

   E. Certification

      (1) Manufacturer shall supply a notarized document confirming compliance with the above standards.

   F. Manufacturers

(1) Centennial Plastics, Charter Plastics, Flying W Plastics, Lamson Vylon Plastics, Chevron Phillips, or Polypipe

G. Warranty

(1) Manufacturer shall supply a written warranty of 25 years or greater, specifying material replacement and labor allowance. This applies to all pipe, fittings, transitions, valves, etc.

4. PIPE JOINING METHODS

A. The only acceptable method for joining buried pipe systems is by a heat fusion process.

B. Polyethylene pipe shall be butt or socket fused in accordance with pipe manufacturer's procedures.

C. Factory installed "U" bends shall be used at the bottom well bend.

5. CASING

A. Casing shall be steel. PVC casing is not acceptable.

B. The Contractor shall include in the bid an allowance for 20 feet of permanent left-in-place steel casing per each new geothermal well indicated on the drawings (excluding the previously installed test wells). The actual amount of casing used per hole shall be tracked with a casing log and wellfield schematic. Schematic shall depict geothermal wells and provide labels for each. Log shall state the bore hole number (as depicted on the schematic), date and time casing was installed, and linear feet of casing left in place for **each** bore hole. For example:

Bore hole # 1	8/1/09	2 P.M.	30 feet of casing installed
Bore hole # 2	8/2/09	9 A.M.	10 feet of casing installed

This log shall be kept current at all times and be **signed daily during drilling** by the well field installer, mechanical contractor, General Contractor and Owner's representative.

C. Contractor shall submit a unit price for steel casing left in place on the Bid Form. In no case will a unit price greater than $19 / linear foot be accepted. Bids not complying with this requirement may be rejected.

D. The casing log and the submitted casing unit price will be used to reconcile the Contract Amount with the actual amount of casing installed. The Contractor will only be paid the full unit price for casing left in place. Push and pull casing (temporary casing) will be paid at half the rate for casing left in place.

6. FLUSHING, PURGING, PRESSURE AND FLOW TESTING

A. General

(1) Coordinate this section with the cleaning and flushing listed in Section 230200 - HVAC Equipment.

(2) All fusion joints and loop lengths shall be checked to verify that no leaks have occurred due to fusion joining or shipping damage.

B. Pressure Testing

(1) Vertical loops shall be pressure tested before installation. All horizontal components of the ground heat exchanger will be flushed, pressure and flow tested prior to backfilling. Pipes must contain fluid under pressure during backfilling.

(2) Heat exchangers shall be tested hydrostatically at 150% of the pipe design rating or 300% of the system operating pressure if this value is the smaller of the two. No leaks shall occur within a 48-hour period. Engineer shall be notified when system is to be placed under pressure test.

C. Flushing and Purging

(1) Notify the Engineer a minimum of 2 weeks in advance of system flushing. The Engineer, Mechanical Contractor, Heat Pump Supplier, Test and Balance Contractor, and Well Field Installer shall all be present to observe system flushing and purging. Schedule the system flushing to occur the same day as a regularly scheduled progress meeting. The Engineer MUST BE PRESENT. Failure to notify the Engineer in advance will result in the Contractor having to flush the system a second time.

(2) Flow rates shall be compared to calculated values to assure that there is no blockage or kinking of any pipe. Submit this in writing to the Engineer. Balance Contractor to verify.

(3) A minimum velocity of 3 ft/sec in each piping section must be maintained until all air is removed. Piping 8” and larger shall be purged at 4 ft/s minimum. The system shall also be forward and reverse flushed to remove all debris. The building shall be flushed in sections as required to maintain high velocities. Building mains shall be flushed separate from branches to maintain high velocity when flushing the mains.

(4) Final purging of air from the entire building and loop field shall be performed by the Well Field Installer so that air in building piping will not be transferred to the well field.

(5) The Balance Contractor must witness and confirm all pressure tests and flushing velocities along with confirm pressure drop for each geothermal well zone.

(6) Contractor shall provide full size connection ports and valves as required to purge wellfield and building separately.

(7) After the heat pump bypasses are flushed and the piping network is determined to be clean and free of air, the heat pumps themselves shall be flushed.

(8) The system flushing device shall be equal to a Purge Pro Max distributed by Geothermal Supply Company. The flushing pump shall provide performance equal to or exceeding

the following values: 550 GPM at 117 PSI, 500 GPM at 115 PSI, 300 GPM at 125 PSI, dead head pressure of 128 PSI. SUBMIT PUMP CURVE to Engineer for review and approval prior to system flush. The flushing device shall provide means to release entrained air to the atmosphere and shall filter the water. Filter shall be 50 micron. Water shall be circulated and filters shall be changed until debris is no longer visible on filter. Contractor shall provide filter media as required.

7. HORIZONTAL PIPING SYSTEMS

   A. Sharp bending of pipe around trench and bore hole corners must be prevented by using a shovel to round corners. Manufacturer's procedures must be followed.

   B. Backfilling procedure will include prevention of any sharp-edged rocks from coming into contact with the pipe by removal of the rocks before backfilling, backfilling through a coarse screen for a 6-inch cover, or use of a 6-inch cover of rock-free soil. Clods resulting from use of a backhoe must be broken up so as not to form air pockets around the pipe which will reduce heat conduction between the earth and the pipe. The flow of backfill soil must be controlled to prevent bridging and the formation of air pockets. Several slow passes with an angled backfill blade are required. Flooding is required to assure removal or air pockets. Since most of the horizontal piping is below the parking lot, the backfill shall support the expected bus traffic. Backfill load bearing capacity shall meet the Architect's specification.

   C. Horizontal return bends must be backfilled by hand to properly support the pipes and prevent kinking.

   D. All horizontal piping shall be a minimum of 42 inches below finished grade.

8. BORE HOLE

   A. The Contractor shall bore wells of a sufficient diameter to allow installation of the piping and U-bend, but shall be no less than 4-1/2".

   B. The entire bore shall be grouted as recommended by IGSHPA with a thermally enhanced grout mixture with a thermal conductivity of 1.00 Btu/hr-ft-˚F. Grout shall be GeoPro Thermal Grout Lite 100 bentonite mixture or approved equal. Mixture shall be field mixed in strict accordance with manufacturer’s recommendations. Grout mixture shall be mechanically pumped with a positive displacement pump into bore hole from bottom to top utilizing a tremie tube. Through the course of the project, three sample grout specimens shall be taken of the mixed grouting material by this contractor. An analysis shall be performed by the grout manufacturer to verify proper thermal performance and grout mixture. This contractor shall submit these reports to the Owner, Architect and Engineer to verify compliance with the installation specifications.

   C. If large water seams are encountered, bridging across water seams with #7 or #9 rock, or GeoPro Black Hills 3/8-inch Bentonite Plug, is acceptable. The maximum height of the rock or bentonite bridge shall not exceed 8 feet. The remainder of the vertical bore hole shall be grouted per the above specification. Bore holes with water seams shall be monitored for settling of grout. After a period of one week, all holes shall be topped off with grout as needed. The Contractor shall continue to monitor holes that experience grout settling and continue to

top off with grout throughout the warranty period. Bore holes that are unable to hold grout shall be replaced with new bore holes at no cost.

D. The Contractor shall accept the site as-is and is responsible for any and all required casings. If an area of voids is encountered, the Contractor shall either fill or re-drill wells in an approved area and extend piping to them.

E. No night drilling will be allowed.

9. DUST CONTROL

A. The Contractor is responsible for and shall provide dust control. Dust shall not be allowed to leave the construction site boundaries, and furthermore, shall not be allowed to enter the building or accumulate on the building exterior. When needed to meet these requirements, the Contractor shall provide and operate a mechanical dust collection system to control dust at the source. Mechanical dust collection system shall consist of collection hood at the source ducted to a dust collector which separates dust from the airstream. Dust shall be collected into sealed containers for disposal by the Contractor.

B. Water spraying may be used but shall not be considered a substitute for mechanical dust collection at the source when required.

10. SURFACE WATER / MUD / SLURRY CONTROL

A. The Contractor is responsible for and shall provide control of all ground flowing fluids resulting from drilling operations. The Contractor shall erect silt fences or other structures as required to contain drill cuttings, mud, slurry, etc. within the construction site boundaries. In the event this requirement is not met, the Contractor shall provide all remediation measures as required by all authorities having jurisdiction over such events.

11. WARRANTY

A. The entire ground loop system and backfill from a point 5 feet inside the building shall be warranted for **five (5) years** from date of substantial completion against any leakage or failure. Warranty service for a pipe leak shall include recharging system with heat transfer fluid as originally specified, including glycol or ethyl alcohol if originally specified, as well as corrosion inhibitors.

12. BALANCE

The Contractor shall assist the Balance Contractor in balancing the geothermal well zones to obtain the specified flows.

13. SUBMITTALS

A. Submit manufacturer's specification sheets and installation instruction for each component of the system, showing manufacturer, pipe or tube weight, pressure rating, fitting type and joint type for each piping system.

B. Submit manufacturer's mechanical data for valves.

C. Submit a drawing indicating the system layout and pipe sizes.

D. Provide a copy of the technician's certification, and International Ground Source Heat Pump Association Certification.

14. TEST BORES

A. Test bore was not performed for this project. One must be performed and submitted to the engineer before installation of the geothermal well field. The contractor shall refer to the form of proposal and provide unit prices for a typical bore hole, drilled, grouted, and piping installed $/bore-foot.

Geothermal Test Bore Scope:

1. One, 400 ft. test bores with associated report delineating geological materials and conditions encountered, i.e., voids, water, limestone, etc. Provide drill log for the bore and submit a drill log in report.

2. 1-1/4" SDR-09 polyethylene piping shall be installed in the test bore. This shall be installed by a certified water well driller to ensure no encountered aquifers are compromised. Bore holes shall be grouted as recommended by IGSHPA to ensure good heat transfer. Local and state laws and regulations for backfilling requirements shall be followed. See IGSHPA Grouting Procedures Manual for detailed grouting procedures. The bore hole annulus shall be completely grouted to ensure there are no air voids and to ensure there is consistent contact between the vertical piping and the bore hole formation. This will require the bore annulus to be filled with grout from the bottom to the top with a "tremie" tube. The entire bore shall be grouted with a thermally enhanced grout mixture with a thermal conductivity of 1.00 Btu/hr-ft-˚F. Grout shall be GeoPro Thermal Grout Lite 100 bentonite mixture or approved equal. Mixture shall be field mixed in strict accordance with manufacturer's recommendations. Grout mixture shall be mechanically pumped with a positive displacement pump into bore hole from bottom to top utilizing a tremie tube. One grout specimen sample shall be taken of the mixed grouting material by the contractor. An analysis shall be performed by the grout manufacturer to verify proper thermal performance and grout mixture. This contractor shall submit these reports to the Engineer to verify compliance with the installation specifications.

3. The bore hole must rest 3-5 days due to drill friction to obtain and accurate ground temperature reading.

4. ONE - 48-hour thermal conductivity test shall be performed on an installed well in accordance with accepted industry practice. Contractor to select one well to perform conductivity test on.

5. If well casing is required to install the test bores, contact Engineer prior to installing. Casing allowance (steel casing only, PVC not allowed) is $27.00 per linear foot. Steel casing shall be permanent and left in place if required.

6. The driller must visit the site prior to submitting a proposal and include all costs for transporting the rig to the test site.

7. The driller must coordinate with all existing site utilities. The driller is required to contact Call Before You Dig and have utilities marked. The driller shall protect existing utilities as required. Utilities include but are not limited to (Sanitary, Electrical, Water, Gas, Communications, Storm, Etc.)

8. Contractor shall mark and protect the wells to owner's satisfaction.

9. The contractor shall leave the test bore piping in the earth capped and protected to be used with complete field in the future. The test bore shall be surrounded by temporary safety fencing and marked with warning signs during drilling and testing operations.

10. All drilling spoils are to be removed from site and disposed of by contractor.

11. The Contractor is responsible for and shall provide dust control. Dust shall not be allowed to leave the construction site boundaries, and furthermore, shall not be allowed to enter any nearby buildings or accumulate on the grass, parking lot or exterior of any nearby buildings. The Contractor shall provide and operate a mechanical dust collection system to control dust at the source. Mechanical dust collection system shall consist of collection hood at the source ducted to a dust collector which separates dust from the airstream. Dust shall be collected into sealed containers for disposal by the Contractor. Water spraying may not be used as a method of dust control.

12. Surface water / mud / slurry control: The Contractor is responsible for and shall provide control of all ground flowing fluids resulting from drilling operations. The Contractor shall erect silt fences or other structures as required to contain drill cuttings, mud, slurry, etc. within the construction site boundaries. In the event this requirement is not met, the Contractor shall provide all remediation measures as required by all authorities having jurisdiction over such events. The contractor has the option to provide means of pumping and removing slurry from the site, but shall coordinate offsite disposal with local jurisdiction.

13. The site shall be readily available for drilling beginning on upon award of contract.

14. A site layout showing the location of the bores will be provided to the Contractor selected to complete the work.

END OF SECTION 20 13 20

SECTION 20 21 00 - VALVES AND COCKS

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

   B. The Contractor shall provide all valves required to control, maintain and direct flow of all fluid systems indicated or specified. This shall include, but may not be limited to all valves of all types including balancing cocks, air cocks, lubricated plug cocks, packed plug cocks, special valves for special systems, etc., for all Mechanical Systems.

   C. All valves shall be designed and rated for the service to which they are applied.

   D. The following type valves shall not be acceptable: Zinc, plastic, fiber or non-metallic.

   E. Ball valves with temperature and pressure ports are not an acceptable alternative to the balancing valves specified herein. Valves that do not comply with these specifications shall be removed and replaced by the Contractor with no increase in contract price.

   F. Each type of valve shall be of one manufacturer, i.e., gate valves, one manufacturer, globe valves, one manufacturer, silent check valves, one manufacturer, etc. The following valve manufacturers shall be acceptable: Lunkenheimer, Tour & Anderssen, Powell, Nibco, Crane, Jenkins, T & S Brass, Walworth, Milwaukee, DeZurik, Consolidated Valve Industries, Inc., Victaulic, Bell & Gossett, Flow Design, Watts.

   G. All valves shall comply with current Federal, State and Local Codes.

   H. All valves shall be new and of first quality.

   I. All valves shall be full line size. Valves and hydronic specialties shall not be reduced to coil or equipment connection size. Size reductions shall be made at the connection to the equipment.

   J. Angle stops for plumbing fixtures shall be quarter turn ball type.

   K. All valves for use in potable water systems shall comply with federal lead free requirements that the lead content of wetted surfaces cannot exceed 0.25% by weight.

2. LOCATION OF MAINTENANCE VALVES

   Maintenance valves and unions, installed so as to isolate equipment from the system shall be installed at the following locations:

A. At each plumbing fixture.

B. At each air handling unit and heat pump.

C. At each heating or cooling coil.

D. At all other locations indicated on the drawings.

3. WORKMANSHIP AND DESIGN

A. Handwheels for valves shall be of a suitable diameter to allow tight closure by hand with the application of reasonable force without additional leverage and without damage to stem, seat and disc. Seating surfaces shall be machined and finished to insure tightness against leakage for service specified and shall seat freely. All screwed valves shall be so designed that when the screwed connection is properly made, no interference with, nor damage to the working parts of the valve shall occur. The same shall be true for sweat valves when solder or brazing is applied.

4. TYPES AND APPLICATION

A. GATE VALVES

Gate Valves shall be of the wedge disc type, permit straight line flow, complete shut-off and designed so that when the valve is wide open, it can be packed under pressure. Valves 1-1/2 inches and smaller shall be bronze, with ends to suit piping and non-rising stem. The valve shall have a deep stuffing box for long contact with the stem, packing gland and filled with high quality packing. Valves 2 inches thru 4 inches shall be iron body bronze mounted with flanged ends and non-rising stem. Boiler stop valves and valves larger than 4 inches shall be iron body bronze mounted flanged ends with outside screw and yoke with rising stem. Working pressure for bronze valves shall be 150 pounds and iron valves 125 pounds when installed in piping with system pressures up to 100 pounds per square inch and 250 pounds for 100 pounds per square inch and over. 2" and under NIBCO T133, greater than 2" NIBCO F619. All gate valves 2” and smaller for use in potable water systems shall meet federal requirement to be lead free containing less than 0.25% lead by weight of wetted area. NIBCO F768B.

B. GLOBE VALVES

Globe Valves shall permit control of flow rate from full flow to complete shut-off and designed that when the valve is wide open it can be repacked under pressure, and have a deep stuffing box with gland and filled with high quality packing. Valves 1-1/2 inches and smaller shall be bronze with ends to suit piping union bonnet, and with stainless steel plug type disc and seat of not less than 500 Brinnell hardness. Valves 2 inches and larger shall be iron body bronze mounted with flanged ends, yoke bonnet, and disc guide. Working pressure for bronze valves shall be 150 pounds and iron valves 125 pounds when installed in piping with system pressures up to 100 pounds per square inch and 250

pounds for 100 pounds per square inch and over. 1-1/2" and under NIBCO T256AP, greater than 1-1/2" NIBCO F768B.

C. CHECK VALVES

Check Valves shall be horizontal swing type with two piece hinges, disc construction seats to be bronze and bronze discs or with composition face depending on service and provide silent operation. Valves 1-1/2 inches and smaller shall be bronze with ends to suit piping, have full area "Y" pattern body and integral seats. Valves 2 inches and larger shall be iron body brass mounted and with flanged ends. Working pressure for bronze valves shall be 150 psi and iron valves 125 psi when installed in piping with system pressures up to 100 psi and 250 psi for 100 psi and over. 3" and under NIBCO T433Y, greater than 3" NIBCO F918B (for less than 100 psi systems) greater than 3” NIBCO F968B (for 100 psi or greater systems).

D. BALL VALVES (NON-POTABLE)

Ball Valves shall have removable lever handle with vinyl grip, adjustable stem gland screw, reinforced Teflon stuffing box ring, blow out proof stem, bronze body, reinforced Teflon seats, chrome plated steel ball as manufactured by Consolidated Valve Industries, Inc., Lunkenheimer, Apollo, Jenkins, Nibco or equivalent. Provide a stem extension so that the base of the handle is 1/4" above the insulation. NIBCO T5800-70.

E. BALL VALVES (POTABLE WATER)

All valves for use in potable water systems 2” and smaller contain less than 0.25% lead by weight and comply with federal lead free potable water requirements. Ball valves shall have a removable lever handle with vinyl grip, adjustable stem gland screw, reinforced Teflon stuffing boxring, blowout proof stem, stainless steel or bronze body, reinforced Teflon seats, stainless steel or chrome plate steel ball as manufactured by Appollo, Aslo, Nibco, Milwaukee, or equivalent. Provide a stem extension so that they bas of the handle is ¼” above the insulation. NIBCO S-585-66-LF.

F. BUTTERFLY VALVES

Butterfly valves shall be line sized cast iron body, lug style, 200 PSI rating (bubble tight) EPT or Viton seat, cartridge type; high strength stem. Disc to have ground and polished seating surface. Operator shall be locking lever style. Quality equivalent to Crane Monarch series. 3" and under NIBCO LD3222-3, greater than 3" NIBCO LD322-5.

G. BALANCING VALVES

Bell & Gossett, Model CB circuit setter balancing valve or approved equivalent. Calibrated balancing valve shall have flanged connections suitable for 125# working pressure at

250°F. 4” and up shall be rated at 175# at 250°F working pressure. Provide with brass readout valves fitted with an integral EPT insert and check valve. Each balance valve shall have a calibrated nameplate to assure specific valve settings and be constructed with internal seals to prevent leakage.

H. GAUGE COCKS

Straight, Lunkenheimer, Fig. 1178; 125#; bronze; tee handle. FIP.

I. LUBRICATED PLUG COCKS

2" and under; Homestead Fig. 601; 150#; semi-steel; screwed; 2-1/2" and over; Homestead Fig. 602; ±50#; semi-steel; flanged.

J. PACKED PLUG COCKS

2" and under; DeZurik Fig. 425-S; 175#; semi-steel; screwed. 2-1/2" and over; DeZurik Fig. 425-F; 175#; semi-steel; flanged.

END OF SECTION 20 21 00

SECTION 20 21 10 - ACCESS TO VALVES, EQUIPMENT, FILTERS, ETC.

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Requirements-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

   B. All mechanical equipment shall be installed in a manner which allows ready access to all components requiring service, adjustments, shutoff, etc.

   C. Filters shall be accessible, removable and replaceable without disconnecting mounting brackets, piping, wiring, etc.

   D. All oil cups, grease cups, grease fittings, etc. shall be accessible without disassembly of equipment, piping, ductwork, etc. (Extended oilers or grease fittings may be required).

   E. Provide access doors or panels for all equipment, valves, dampers, filters, fire dampers, etc. in concealed spaces not otherwise provided with suitable access. (Lay-in ceilings shall be considered acceptable access; splined or drywall ceilings shall not).

   F. All valves, unions, strainers, cleanouts, volume dampers, and test points shall be accessible.

   G. Access panels in lay-in ceilings shall be marked with colored tacks to indicate location of equipment, filters, valves, etc.

   H. Access panels in fire rated walls shall bear the same rating as the wall.

   I. Each fire damper shall be provided access through the duct to allow reset of the damper. This may be either a gasketed sheet metal panel over a suitable opening or a factory built access panel. The panel shall be at least one and one-half (12) inch larger than the opening all around and shall be held in place with sheet metal screws sufficiently to insure that it is air tight. Manually check the size and location of each of these openings to insure that the fire damper may be manually reset by use of hand only.

2. ACCESS DOORS

   Refer to Sheet Metal and Flexible Duct section of the specifications.

END OF SECTION 20 21 10

SECTION 20 22 00 - INSULATION - MECHANICAL

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

   B. Work under this section shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for all mechanical systems specified herein and/or as indicated.

   C. Application of insulation materials shall be done in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use. Insulation shall be applied by a company regularly engaged in the application of insulation and any work deemed unacceptable by the Engineers shall be removed and properly installed at the expense of the Contractor.

2. MANUFACTURERS

   A. Insulation shall be as manufactured by Manville, Knauf, CertainTeed, Owens-Corning, Armacell or other approved equivalent. Insulation sundries, adhesives, and jackets/covers shall be as made by Benjamin Foster, Zeston, Speedline, Proto, Childers, Vimasco or approved equivalent.

3. FIRE RATINGS AND STANDARDS

   A. Insulations, jackets and facings shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255 and UL 723 procedures not exceeding Flame Spread 25, Smoke Developed 50.

   B. Adhesives, mastics, tapes and fitting materials shall have component ratings as listed above.

   C. All products and their packaging shall bear a label indicating above requirements are not exceeded.

   D. Duct linings shall meet the Erosion Test Method in compliance with UL Publication No. 181.

4. GENERAL APPLICATION REQUIREMENTS

   A. Insulation shall be applied on clean, dry surfaces in a neat and workmanlike manner reflecting the best current practices in the trade. Insulation shall not be applied to piping, ductwork or equipment until tested, inspected and released for insulation.

B. All insulation shall be continuous through walls, ceiling openings and sleeves. However, insulation shall be broken through fire walls. All covered pipe and ductwork is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. If necessary, extra fittings and pipe are to be used. No noticeable deformation of insulation or discontinuity of vaporseal, where required, will be accepted.

C. "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Piping, ductwork, and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as "exposed". Any insulation visible from the exposed space either between ceilings, clouds, soffits, etc. is considered “exposed”.

D. Vapor barrier jackets shall be applied with a continuous unbroken vapor seal. Do not use staples thru the jacket. NO EXCEPTIONS!

E. All insulation shall be installed with joints butted firmly together.

F. The Contractor shall insure that all insulation (piping, ductwork, equipment, etc.) is completely continuous along all conduits, equipment, connection routes, etc. carrying cold fluids (air, water, other) and that condensation can, in no way, collect in or on the insulation, equipment, conduits, etc. Any such occurrence of condensation collection and/or damage therefrom shall be repaired solely at the expense of the Contractor.

5. PIPING SYSTEMS

A. GENERAL

(1) Bevel insulation and jacket at all points where insulation terminates at unions, flanges, valves and equipment. Note: Applies to hot water lines only; cold water lines require continuous insulation.

(2) Geothermal piping systems, shall be insulated continuously like a chilled water system. This requirement extends to all components in the system (pump impeller housing, unions, flanges, valves, air separators, sidestream filters, hydronic specialties, valves and flex hoses to heat pumps, etc.).

(3) Pipe insulation shall extend around valve bodies to above drain pans in hydronic equipment over pumps, etc. to insure no condensation drip or collection.

(4) Factory molded fittings may be installed in lieu of built-up fittings. Jackets to be the same as adjoining insulation. Insulated fittings must have same or better K factors than adjoining straight run insulation.

(5) Valves, flanges and unions shall only be insulated when installed on piping whose surface temperature will be at or below the dew point temperature of the ambient air.

(6) Insulation shall not extend through fire and smoke walls. A UL-listed penetration system shall be used for each fire or smoke wall penetration in accordance with KBC. Materials used such as caulk, sleeves, etc. shall be manufactured by 3M, Hilti, or equal.

B. INSULATION SHIELDS

(1) Metal insulation shields are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 degree arc. Insulation shields shall be the following size:

PIPE SIZE	SHIELD GAUGE	SHIELD LENGTH
2" AND LESS	20	12"
2 1/2" TO 4"	18	12"
5" TO 10"	16	18"
12" AND GREATER	14	24"

C. INSULATION MATERIAL (FOR THE FOLLOWING SYSTEMS)

Insulation shall be Owens-Corning Model 25ASJ/SSL, or approved equivalent fiberglass pipe insulation with an all service jacket. The insulation shall be a heavy density, pipe insulation with a K factor .23 at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket approved manufacturers are listed in section 2. Manufacturers. The jacket shall have an inside foil surface with self sealing lap and a water vapor permeability of .02 perm/inch. All circumferential joints shall be vapor sealed with butt strips. All insulation shall be installed in strict accordance with the manufacturers' recommendations. The following pipes shall be insulated with the thickness of insulation as noted.

(1) Domestic Cold Water

a. Piping 3'' or less – use 1/2" thick insulation.

b. Piping 4'' or greater – use 1'' thick insulation.

(2) Domestic Hot Water and Recirculating Hot Water.

a. Piping 1 ½'' or less – use 1 ½'' thick insulation.

b. Piping 2'' or greater – use 2'' thick insulation.

(3) Geothermal Heat Pump Piping – not required where HDPE piping material is used.

a. Piping 1 ½'' or less – use ½'' thick insulation.

b. Piping 2” and greater – use 1” thick insulation.

(4) Horizontal Roof Leaders.

a. Piping 3’’ or less – use 1/2" thick insulation

b. Piping 4’’ or greater – use 1’’ thick insulation

(5) Sanitary Sewer and plumbing fixture P-traps to waste stack. Insulate horizontal runs which receive air conditioning condensate and which are not located below slab or grade.

a. Piping 3’’ or less – use 1/2" thick insulation

b. Piping 4’’ or greater – use 1’’ thick insulation

(6) Condensate Drain Lines.

a. Piping 1 ½’’ or less – use 1/2" thick insulation

b. Piping 2’’ or greater – use 1’’ thick insulation

(7) Refrigerant Liquid and Suction Lines - Interior & Exterior

IMCOA, Nomaco, or Armacell closed cell polyethylene, 1.5 Lbs/Ft^3 density, 0.24 BTU-Hr.-Ft^3-°F/in at 75°F thermal conductivity, zero vapor permeance, 25/50 flame and smoke spread per NFPA 90 requirements. Elastomeric closed cell insulations that meet the above requirements are also allowed. Install insulation per the manufacturer’s requirements.

a. All pipe sizes: 1 ½’’ thick

D. JACKETS

(1) Exposed (Mechanical Rooms, Interior Finished Rooms and Storage Rooms)

All insulated piping installed in the above areas shall have a canvas or PVC jacket:

a. 6 oz. canvas jacket with fire retardant lagging. Apply to the insulation specified for the piping.

b. For all piping systems, plenum rated PVC jacket equal to LoSmoke PVC jacket with flame/smoke rating of 25/50, ASTM-E84 test method. Minimum thickness 0.04 inches. Jackets shall be applied over top of specified pipe insulation. Approved equal manufacturers are Zeston and Speedline. Approved equal manufacturers are Zeston and Speedline.

6. DUCTWORK SYSTEMS

A. GENERAL

(1) Duct sizes indicated are the net free area inside clear dimensions; where ducts are internally lined, overall dimensions shall be increased accordingly.

(2) Duct insulation shall extend completely to all registers, grilles, diffusers, and louver outlets, etc., to insure no condensation drip or collection. The backs of all supply diffusers, plenums, grilles, etc. shall be insulated only if indicated by details on the drawings.

(3) All flexible duct connections on insulated ductwork shall be externally insulated.

(4) All duct outside of building envelope, including rooftop duct, duct in unconditioned attic spaces above the insulation, etc. shall have two layers of specified insulation. This shall apply to supply air, exhaust air where air is run through energy recovery unit, outside air, return air, and combustion air intake ducts.

B. EXTERNAL INSULATION

(1) Supply Air
(2) Outside Air from Exterior to OA Unit Inlet
(3) Exhaust Air from Exterior to OA Unit Outlet
(4) Exhaust air from fan backdraft damper to exterior

Owens/Corning “Faced Duct Wrap - Type 100", or approved equal, 2" thick fiberglass duct wrap, 1 lb. density factory laminated to a reinforced foil kraft vapor barrier facing (FRK) with a 2" stapling flange at one edge. Flame spread 24, smoke developed 50, vapor barrier performance 0.02 perms per inch. K factor shall not exceed .26 at 75°F. mean temperature. Minimum R-value of the 2’’ thick insulation shall be 7.4 out of the package and 6.0 installed.

C. EXPOSED EXTERNALLY INSULATED DUCT

(1) Round. 1 ½’’ semi-rigid fiberglass tank and pipe wrap with kraft aluminum foil all service jacket vapor barrier or PSK facing. K=.27 @ 75°F. Minimum R-value shall be 5.5. Provide 6 oz. canvas jacket with fire retardant lagging.

(2) Rectangular. rigid fiberglass industrial board with foil scrim kraft vapor barrier facing or PSK facing, 6.0 PCF density, K=.22 @ 75°F. Owens/Corning type 705. Provide 6 oz. canvas jacket with fire retardant lagging minimum R value shall be 5.5.

7. MECHANICAL EQUIPMENT

A. ROOF DRAIN SUMPS

(1) Owens-Corning Model 475-FR or approved equivalent rigid board insulation with exterior vapor barrier jacket formed to bottom of sump basin. Insulation shall have a

K factor of .22 at 75°F. mean temperature. Insulation shall be 1" thick. Insulation shall be formed to roof drain sump. Vapor barrier shall remain continuous.

B. FLOOR DRAIN SUMPS (Applies to all Floor Drains which Receive Air Conditioning Condensate and which are Installed in Locations Other Than Slab on Grade)

(1) Owens-Corning Model 475-FR or approved equivalent rigid board insulation with exterior vapor barrier jacket formed to bottom of sump basin. Insulation shall have a K factor of .22 at 75°F. mean temperature. Insulation shall be 1" thick. Insulation shall be formed to roof drain sump. Vapor barrier shall remain continuous.

C. EXPANSION TANK, COMPRESSION TANK, AIR SEPARATOR, SIDESTREAM/LOOP FILTERS, AND HOT WATER STORAGE TANKS

(1) Owens-Corning "Tank Wrap I" or approved equivalent. Insulation shall be constructed of non-combustible, flexible wool. Insulation shall be 2" thick. K factor shall be .29 at 100°F. mean temperature. Insulation shall be attached in strict accordance with the manufacturer's recommendations. All insulation shall be jacketed with 6 oz. canvas with fire retardant lagging. Coordinate with mechanical contractor to extend all piping connections, blowdown ports, etc. outside of the insulation. Additionally for loop filters and other equipment requiring periodic service, provide removable insulated covers.

END OF SECTION 20 22 00

SECTION 20 23 00 - THERMOMETERS AND OTHERS, MONITORING INSTRUMENTS

1. GENERAL

   A. The Contractor shall include all thermometers, pressure gauges and/or compound gauges at the locations indicated.

2. THERMOMETERS AND PRESSURE GAUGES

   A. All thermometers and gauges shall be readable from a standing position on the floor.

   B. Thermometers shall be linear, alcohol filled, graduated in 1°F. Or less and shall have adequate range for service intended.

   C. Pressure gauges shall be Bourdon Type, circular, 3" face, black letters on white face graduated in 2 PSI or less and shall have adequate range and shall be manufactured for service intended. Provide with pig tail connectors and gauge cocks.

   D. Pressure gauges and thermometers subject to vibration shall be mounted remotely away from vibrating pipe surface, etc., with flexible tubing.

   E. Mount thermometers in approved wells and install with thermal grease. Do not make direct contact of base with fluid in pipe.

   F. Gauges and thermometers shall be Marsh, Marshalltown, Weksler or equivalent.

3. Provide, when indicated on the plans, on the inlet and outlet of each terminal unit, a “Pete’s Plug” or equivalent pressure/temperature test station. Furnish two (2) matching thermometers and pressure gauges to the owner upon project completion.

END OF SECTION 20 23 00

SECTION 20 24 00 - IDENTIFICATIONS, TAGS, CHARTS, ETC.

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

2. VALVE TAGS AND CHARTS

   A. Provide and install on each valve in the Mechanical Systems a 1-1/2" diameter circular brass tag fitted to each valve so that it cannot be removed. Each tag shall be embossed consecutively with letter and number identifiers as to system and purpose respectively. Letter identifiers shall be as follows:

H	Heating
C	Cooling
DCW	Domestic Cold Water
DHW	Domestic Hot Water
RHW	Recirculating Hot Water
HPS	Heat Pump Supply
HPR	Heat Pump Return
FP	Fire Protection

   Number identifiers shall be determined by the Contractor sequentially. For example, valve No. HC-1 may be maintenance stops for fan coil units. HC-2 maintenance stops for air heaters, etc.

   B. Provide three (3) copies of typewritten valve charts indicating each valve identifier, the valves purpose and its location. For example: "HC-1 Fan Coil Maintenance Stop-one valve at supply and return of each fan coil unit." One (1) copy of this chart shall be mounted in suitable wood frame(s) with clear plastic or glass covers in a conspicuous location in the Mechanical Room. Two other copies shall be turned over to the Engineers.

   C. Where more than one major Mechanical room is indicated for the project, install mounted valve schedule in each major Mechanical Room, and repeat only main valves which are to be operated in conjunction with operations of more than single Mechanical Room.

3. PIPING IDENTIFICATION

   A. GENERAL

      (1) Provide stenciled markers and arrows indicating direction of flow on all piping installed under this Contract after the piping has been painted. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that

descriptive name may be easily read from the floor. At the Contractor's option, Setmark or equivalent manufactured marking system may be substituted for field marking. The following table describes the size of the color field and size of the identification letter which shall be used for pipes of different outside pipe diameters.

OUTSIDE DIAMETER OF PIPE OR COVERING	LENGTH OF FIELD	SIZE OF LETTERS
INCHES	INCHES	INCHES
3/4 TO 1-1/4	8	1/2
1-1/2 TO 2	8	3/4
2-1/2 TO 6	12	1-1/4
8 TO 10	24	2-1/2
OVER 10	32	3-1/2

(2) "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Pipng and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as "exposed".

B. PAINTING (REFER ALSO TO ARCHITECTURAL SECTION ON PAINTING)

(1) Paint all equipment and metal surfaces which are not factory finished (and all damaged or rusted surfaces) in high grade rust proofing machinery enamel. Pay particular attention to flanges, valves, unions, etc., where condensation may collect.

(2) Paint exposed pipe (whether insulated or bare) and exposed surfaces (tanks, etc.).

(3) All piping shall be identified in accordance with the following coding chart.

PIPE+	ABBREVIATION
Heat Pump Supply	H.P.S.
Heat Pump Return	H.P.R.
Domestic Cold Water	D.C.W.
Domestic Hot Water	D.H.W.
Recirculated Hot Water	R.H.W.
Sanitary Sewer Piping	SAN.
Sanitary Vent Piping	VENT
Storm Sewer Piping	STORM
Fire Protection Piping	F.P.

+ Where a pipe is not specifically identified in this table, painting and marking shall be in accordance with the most recent ANSI Standards.

C. Water heaters, storage tanks, heat exchangers, etc., shall be painted light gray.

D. All piping shall be marked. Piping shall be marked not less than every 15 linear feet above a ceiling system, every 10 feet in a mechanical room, and at all points where the piping passes through wall or floors.

4. EQUIPMENT IDENTIFICATION

A. All equipment, except in finished rooms, shall be identified by stenciling the title of the equipment as taken from the plans in a position that is clearly visible from the floor. The letters shall be made with

black paint and shall be not less than two inches high. The titles shall be short and concise and abbreviations may be used as long as the meaning is clear. Lamacoid plates are also acceptable. In finished rooms or outdoors, equipment shall be identified by engraved nameplates.

B. HVAC Equipment Above Ceiling: Provide a lamacoid engraved plate on the ceiling T-bar below the unit.

5. DUCTWORK IDENTIFICATION

A. All ductwork shall be identified as to the service of the duct and direction of flow. The letters shall be at least two inches high and the flow arrow shall be at least six inches long. The letters and flow arrow shall be made by precut stencils and black oil base paint with aerosol can. Concealed ducts need not be identified.

6. ACCESS THROUGH LAY-IN CEILINGS

A. Provide identifying plate on the ceiling T-bar nearest the ceiling panel access to the equipment with a ¾" black and white engraved lamacoid plate with name of item above ceiling.

END OF SECTION 20 24 00

SECTION 20 25 00 - HANGERS, CLAMPS, ATTACHMENTS, ETC.

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Provisions - Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

   B. Each Contractor's attention is also directed to Section 201300, Pipe, Pipe Fittings and Pipe Support.

   C. This section includes, but is not limited to, furnishing and installing dampers, supports, anchors, and accessories for piping, ductwork, equipment, etc. Furnishing and installing shall be by each trade for the completion of their work.

   D. Power driven anchors and expansion anchors shall be permitted only when permission is granted in writing by the Architect and Engineer.

2. MATERIALS AND EQUIPMENT

   A. Hangers, Clamps, Attachments, Etc.:

	SIZE	SPECIFICATION
1. Pipe Rings	2" pipe and smaller	Adjustable swivel split ring or split pipe ring, Grinnell Figures 104 and 108, Elcen, Fee & Mason, or approved equivalent.
2. Pipe Clevis	2-1/2" pipe and larger	Adjustable wrought Clevis type, Grinnell Figure 260, Elcen, Fee & Mason, or approved equivalent.
3. Pipe Clevis	All	Steel Clevis for insulated pipe, Elcen Figure 12A, Grinnell, Fee & Mason or approved equivalent.
4. Rise Clamps	All	Extension pipe or riser clamp, Grinnell Figure 261, Elcen, Fee & Mason or approved equivalent.
5. Beam Clamps and Attachments	All	Grinnell Figure numbers listed or, Elcen, Fee & Mason, or approved equivalent. Malleable beam clamp with extension piece figure 229; I-beam

		clamp figure 131; C-clamp figures 83, 84, 85, 86, 87, and 88.
6. Brackets	All	Welded steel brackets medium weight, Grinnell Figure 195, Elcen, Fee & Mason or approved equivalent.

7. Concrete Inserts	All	Grinnell Figure numbers listed or, Elcen, Fee & Mason or approved equivalent. Wrought steel insert Figure 280 and wedge type insert Figure 281.
8. Concrete Fasteners	All	Self-drilling concrete inserts, Phillips, Grinnell, Elcen or approved equivalent.
9. Ceiling	All	Grinnel Figure numbers listed or Elcen, Fee & Mason, or approved equivalent. Pipe hanger flange Figure 153, adjustable swinging hanger flange Figure 155, ceiling flanges Figures 128 and 128R, and adjustable ceiling flange Figure 116.
10. Rod Attachments	All	Grinnel Figure numbers listed or Elcen, Fee & Mason, or approved equivalent. Extension piece Figure 157, rod coupling Figure 136, and forged steel turnbuckle Figure 230.
11. U-Bolts	All	Standard, U-bolt, Grinnell Figure 137, Elcen, Fee & Mason, or approved equivalent.
12. Welded Pipe Saddles	All	Pipe covering protection saddle sized for thickness of insulation, Grinnell Figure 186, Elcen, Fee & Mason or approved equivalent.
13. Pipe Roll	All	Adjustable swivel pipe roll, Grinnell Figure 174, Elcen, Fee & Mason, or approved equivalent.
14. Protection Saddle	All	18 gauge sheet metal pipe protection saddle, Elcen Figure 219, Fee & Mason, Power Strut, or approved equivalent.
15. Hanger Rods	All	

		Steel, diameter of the hanger threading, ASTM A-107.
16. Miscellaneous Steel	All	Steel angles, rods, bars, channels, etc., used in framing for supports and fabricated brackets, anchors, etc., shall conform to ASTM-A-7.
17. Concrete Channel Inserts	All	Continuous slot inserts, Unistrut, or approved equivalent. Heavy duty Series P-3200 or Light Duty Series P-3300 as required.
18. Adjustable Spot Insert	All	Adjustable spot insert Unistrut, or approved equivalent, P-3245. Design load 1000 lbs.

3. INSTALLATION

A. Unless otherwise specifically indicated or hereinafter specified in the specifications, all supporting, hanging and anchoring of piping, ductwork, equipment, etc., shall be done by each trade as is necessary for completion of the work and shall be as directed in the following paragraphs:

(1) Supporting and hanging shall be done so that excessive load will not be placed on any one hangers so as to allow for proper pitch and expansion of piping. Hangers and supports shall be placed as near as possible to joints, turns and branches.

(2) For concrete construction, utilize adjustable concrete inserts for fasteners. Expansion anchors and power driven devices may be used when approved in writing by the Architect/Engineer. Utilize beam clamps for fastening to steel joists and beams and expansion anchors in masonry construction. When piping is run in joists, piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger.

(3) Trapeze hangers shall be supported by steel rods of sufficient diameter to support piping from joists or concrete construction. Where desired or required, piping may be double mounted on trapeze hangers. Where conditions permit, trapeze hangers may be surface mounted on exposed joists by means of approved beam clamps, or to concrete construction by means of approved adjustable inserts or expansion anchors.

(4) Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross steel joists.

(5) Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment.

(6) Where piping, etc., is run vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum and an approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.

(7) Where piping is run along walls, knee braced angle frames or pipe brackets with saddles, clamps, and rollers (where required) mounted on structural brackets fastened to walls or columns shall be used.

(8) Support all ceiling hung equipment, with approved vibration isolators.

(9) Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.

(10) Uninsulated piping hung from above shall be supported with ring and clevis type pipe hangers. Uninsulated piping mounted on trapeze and wall bracket type support shall be held in place with U-bolts. U-bolts shall allow for axial movement in the piping.

(11) All insulated piping shall be supported with clevis type and/or pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.

(12) Under no conditions will perforated band iron or steel wire driven hangers be permitted.

(13) In general, support piping at the following spacing:

a. Steel and copper piping - 5 feet intervals for piping 3/4" and smaller. 6 feet intervals for 1 ¼” and 1” pipe. 8 foot intervals for piping 1 ½” to 3". 10 foot intervals piping 3 ½” and larger.

b. Polyethylene piping – 4 foot intervals for piping 2” and smaller. 5 foot intervals for 3” pipe. 6 foot intervals for 4”, 6”, and 8” pipe. 7 foot intervals for 10” and larger pipe.

c. PVC piping – 4 foot intervals for piping 1 1/2” and smaller. 5 foot intervals for 2 and 2 ½” piping. 6 foot intervals for 3” pipe and larger.

d. Where the manufacturer of the pipe has more strict guidelines, the manufacturer’s recommendations shall be followed.

END OF SECTION 20 25 00

SECTION 20 31 00 - TESTING, BALANCING, LUBRICATION AND ADJUSTMENTS

1. GENERAL

A. The General Conditions, Instructions to Bidders, Section 200100, and other Contract Documents are a part of this specification and shall be binding on all Mechanical Contractors. It shall be each Contractor's responsibility to apprize himself of all information pertinent to his work prior to submitting his proposal. No adjustments will be made in this Contract which is a result of failure to comply with this requirement.

B. The Engineer, or his authorized representative, shall be notified by the Contractor twenty-four (24) hours in advance of any tests called for in these specifications or required by others. Any leaks or imperfections found shall be corrected and a new tests run to the satisfaction of the Engineer or his authorized representative. Upon completion of a test, a written approval of that part of the work will be given to the Contractor. Only after written approval, signed by the Engineer, shall the Contractor apply insulation or paint or allow his work to be furred-in. This written approval, however, does not relieve the Contractor of the responsibilities for any failure during the guarantee period. The expense of all tests shall be borne by the Contractor, along with all temporary equipment, materials, gauges, etc. required for tests.

2. PLUMBING

A. Piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.

B. Water piping systems shall be subjected to a hydrostatic test of one hundred fifty pounds. The system shall be proven tight after a twenty-four (24) hour test.

C. The house drain line, interior storm sewers, interior rain water conductors, and all soil, waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head or an air test of not less than 5 lbs. per sq. inch using a mercury column gauge and shall hold for 15 minutes.

D. Exterior sewer lines to the termination point outside the building shall be subject to a ten-foot hydrostatic test or an approved smoke test. These lines shall be subjected to a second test after 2 feet of backfill has been properly installed.

E. After fixtures have been installed, the entire plumbing system, exclusive of the house sewer, shall be subjected to an air pressure test equivalent to one inch water column and proven tight. The Contractor responsible shall furnish and install all of the test tees required, including those for isolating any portion of the system for tests.

F. Thermometers and gauges shall be checked for accuracy. If instruments prove defective, they shall be replaced.

G. The Contractor shall perform all additional tests that may be required by the Local Department of Health or other governing agency.

H. Set temperature control on water heaters and adjust tempering valves as required.

I. Balance the water flow rate of each domestic hot water recirculating pump. Set the flow rate for each balancing valve in the recirculating hot water system. If flow rates are not indicated, contact the engineer for each balance valve GPM.

J. Any leaks or imperfections found shall be corrected and a new test run until satisfactory results are obtained. The cost of repair or restoration of surfaces damaged by leaks in any system shall be borne by the Contractor.

3. HEATING, VENTILATING AND AIR CONDITIONING

A. Testing and balancing is the responsibility of the mechanical contractor. Not direct to owner.

B. The test and balance of this system shall be by a contractor who employs only the services of a certified AABC or independent NEBB firm whose sole business is to perform test and balance services. The test and balance contractor shall report all deficiencies to the engineer.

C. The Mechanical Contractor shall test all piping before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory. Water piping systems shall be subjected to a hydrostatic test of not less than one hundred pounds and shall be proven tight after a twenty-four (24) hour test.

C. All motors, bearings, etc. shall be checked and lubricated as required during start-up procedures. All automatic, pressure regulating and control valves shall be adjusted. Excessive noise or vibration shall be eliminated. Provide all start-up documents to Designer prior to any test and balance services.

D. System balancing, where required, shall be performed only by persons skilled in this work. The system shall be balanced as often as necessary to obtain desired system operation and results.

E. All fan belts shall be adjusted for proper operation of fans.

F. All deficiencies observed by the Test and Balance Contractor shall be reported immediately to the Engineer and Mechanical Contractor.

G. For the purpose of placing the heating, ventilating and air conditioning system in operation according to design conditions and certifying same, final testing and balancing shall be performed in complete accordance with AABC Standards for Total System Balance, Volume Six (2002), for air and hydronic systems as published by the Associated Air Balance Council. The following systems shall be test and balance:

(1) The supply, return and outside air duct systems associated with Outside Air Unit. Provide static pressure profiles thru each system. Static pressure profiles shall include

all sections from the return duct inlet and supply duct outlet of the air handling unit. Show accurate representation of return, relief, outdoor and economizer damper locations. On units equipped with return air fans; show location and profile of the return fan.

(2) Verify that the temperature control systems supply and return air flow stations on Outside Air Unit air calibrated corrected. Test at 25%, 50%, 75% and 100% flow rated.

(3) Verify calibrations of the duct static pressure sensors for Outside Air Unit.

(4) Set the minimum and maximum air flow rates for each VAV and CAV box.

(5) Balance all supply, return and exhaust air grille to within 10% of design air flow rate.

(6) Balance all exhaust air fans and record inlet static pressure.

(7) Balance the kitchen rangehood supply/exhaust air system.

(8) Balance domestic hot water return system including all balance valves and record settings and flows.

I. The Test and Balance agency shall provide lifts, scaffolding, etc. as required to balance devices in areas with high ceilings such as gymnasiums, auditoriums, atriums, cupolas, etc. The Test and Balance agency may coordinate with the General Contractor or Mechanical Contractor to arrange for these items to be provided to access high devices, however, it is emphasized the Contractor is finally responsible for providing the means required to balance all devices.

J. Instruments used for testing and balancing of air and hydronic systems shall have been calibrated within a period of six months prior to balancing. All final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.

K. Test and Balance agency is to provide sizing of fan or motor sheaves required for proper balance. The Mechanical Contractor will purchase and install all sheaves and belts as required. This includes new and existing equipment.

L. Four (4) copies of the complete test reports shall be submitted to the Consulting Engineer prior to final acceptance of the project. Preliminary test reports shall be submitted when requested.

M. The Contractor shall provide and coordinate his work in the following manner:

(1) Provide sufficient time before final completion date so that tests and balancing can be accomplished.

(2) Provide immediate labor and tools to make corrections when required without undue delay.

N. The Contractor shall put all heating, ventilating and air conditioning systems and equipment and rangehood system into full operation and shall continue the operation of same during each working day of testing and balancing.

O. The test and balance contractor shall be present during the Engineer's final inspection of the building, or a separate project review date. The Engineer may request confirmation of the air balance report by asking for new measurements to be taken at that time. Any information in the test and balance report may be asked to be reconfirmed.

P. Balance all water and air systems. Be sure to include:

(1) Domestic Hot Water Recirculating System.

Q. Geothermal Balance (Hydronic Balance) Base Bid Boiler/Cooling Tower

(1) Confirm flushing velocities (forward and backward) in geothermal well field.

(2) Confirm pressure drop values for each well field zone.

(3) Set flow rate for each well field zone.

(4) Submit report confirming above geothermal information to the Engineer prior to submission of final balance report.

R. Automatic Flow Control Balance Valves

(1) Verify that each installed automatic flow control device matches the GPM indicated on the drawings.

(2) Verify that the actual pressure at each automatic flow control device is within the pressure limits specified by the valve manufacturer.

4. FIRE PROTECTION SYSTEM

A. Test in accord with local Fire Marshall requirements and/or requirements or recommendations of NFPA Regulations.

END OF SECTION 20 31 00

SECTION 21 01 00 - FIRE PROTECTION SYSTEM

1. GENERAL

A. The General Conditions, Instructions to Bidders, Section 200100, 1. A, and other Contract Documents are a part of this specification and shall be binding on the Contractor. It shall be the Contractor's responsibility to apprise himself of all information pertinent to his work prior to submitting his proposal. No adjustments will be made in this Contract which is a result of failure to comply with this requirement.

B. No Contractor, other than those regularly engaged in the installation of approved and franchised automatic sprinkler systems, will be considered or approved for the work under this section of the specifications. Bidders must have had not less than five (5) years experience in the fabrication and erection of such systems: wet, dry and rack storage types, and shall have completed installations similar and equivalent in scope to this system under approval by one or more of the recognized Underwriting Associations in the Insurance Field.

C. Before submitting bid, examine all Mechanical, Architectural, and Structural Drawings, visit the site and become acquainted with all conditions that may, in any way whatsoever, affect the execution of this work. Also, the Contractor shall coordinate with the rating bureau and insuring agency to verify adequacy of water supply for the proposed sprinkler system extension.

D. The Contractor shall take his own measurements and be responsible for exact size and location of all openings required for installation of this work. Figured dimensions where indicated are reasonably accurate and should govern in setting out work. Detailed method of installation is not indicated. Where variations exist between described work and approved practice, the Engineer shall be consulted for directive.

E. It is the intent of the Plans and Specifications to provide a general layout only and locate major equipment, piping, etc. Variations in head locations, pipe routing, etc., may be anticipated by the Contractor and shall be coordinated with all other trades and indicated on the drawings and descriptive literature called for hereinafter. It shall be the express responsibility of the Contractor to provide all required materials and equipment and perform all work required to install a complete and approved installation.

F. All materials and methods shall be in accordance with applicable codes, regulations and/or ordinances and meet approval of local inspection authority and the State Fire Marshal. Also, all work shall comply with the latest editions of the National Board of Fire Underwriters, National Fire Protection Association, OSHA Regulations, the National Building Code, the Life Safety Code, IMC Code and the Southern Building Code (Where applicable). The local insuring agency shall review plans prepared and submitted by the Contractor but shall have no authority to make changes once work has begun.

G. All work performed under this section shall be accomplished in close harmony with all other trades. All work not so coordinated shall be removed and reinstalled at the expense of the Contractor.

H. The Contractor shall submit a proposed layout to the Engineer prior to submittal to the Fire Marshal's Office.

2. SCOPE OF WORK

A. Furnish all material, labor, tools, equipment and supervision required for installation of a complete fire protection and stand pipe system as indicated on the project drawings. Include all necessary piping, sprinkler heads, test connections, valves, drains, cabinets, siamese connections, fire hydrants, fire pump, etc.

B. The Contractor shall provide flushing and sterilization of all water lines in accordance with current International Plumbing Codes, Rules and Regulations and shall make connection to domestic water mains in accord with current rules and regulations of the State Department of Sanitary Engineering and Division of Water.

C. Provide sprinklers in attics, overhangs, awnings, cooler/freezers, in accessible spaces and all other areas required by NFPA and the local fire authority.

D. Provide seismic restraints in accordance with the IBC.

3. WATER SUPPLIES AND SYSTEM LAYOUT CRITERIA

A. Where flow and pressure data are available, they are indicated on the project drawings. The Contractor shall independently verify all such information and notify the engineer of any discrepancies discovered prior to beginning the work. Where no flow information is indicted on the project drawings, the Contractor shall obtain it and indicate it on the shop drawing submittal. Piping systems shall be hydraulically sized based on the most conservative flow information obtained. No adjustments in the contract amount will be allowed for failure of the Contractor to obtain adequate flow information.

4. DRAWINGS AND DESCRIPTIVE LITERATURE

A. The Contractor shall prepare and submit to the Engineers, seven (7) copies of detailed drawings indicating his proposed Automatic Sprinkler System. These drawings shall indicate minimally the following components when they are used in the system.

(1) Name and address of Owner, Architect and Engineers.
(2) Make and type of sprinkler heads (Catalog cuts).
(3) Make and type of fire department connection (Catalog cuts).
(4) Make and type of post indicator valve (Catalog cuts).
(5) Make and type of detector check valve (Catalog cuts).
(6) Make and type of electric alarm bell (Catalog cuts).
(7) Make and type of flanged check valve (Catalog cuts).

(8) Make and type of flanged gate valve (Catalog cuts).
(9) Make and type of automatic drains (Catalog cuts).
(10) Make and type of pipe hangers (1 catalog cut of each make and/or type).
(11) Make, type and electrical characteristics of:

a. The pressure sensing switch*.
b. The post indicator supervisory switch*.
c. The main gate valve supervisory switch*.
d. The flow switch*.

(12) Make and type of supervised O.S & Y valve.
(13) Make and type of indicating butterfly valve.
(14) Make and type of reduced pressure backflow preventer.

Note: All layouts and drawings are to be closely coordinated with the work of all other trades. The Engineers will, upon request, provide a complete set of Architectural, Structural, Mechanical and Electrical Plans and Specifications to aid the Contractor in this work.

*SPECIAL NOTE: 1) The items (indicated by asterisk) must be clearly coordinated with the Fire Alarm System supplier. 2) Supervisory switches located in wet locations (i.e., fire protection vault) shall be provided with NEMA 6 enclosures.

(15) On a set of drawings to the same scale as the drawings accompanying these specifications, indicate:

a. Each head location coordinated with lights, diffusers and other ceiling mounted device.
b. Location of all risers, mains, runout lines, etc.
c. Size of all risers, mains, runout lines, etc.
d. Location and type of pipe hangers.

The Contractor shall submit these drawings to the Engineer through the General Contractor/Construction Manager and Architect where applicable. The Contractor shall submit reviewed drawings to the Department of Housing, Buildings and Construction for their review and approval. No work shall be done until drawings are approved by the Department of HBC.

5. SYSTEM DRAINAGE

A. The entire Sprinkler System (except that part which is below grade and will not freeze) shall be installed so as to allow 100% drainage.

B. All sprinkler branch piping shall be installed so as to drain back to the main riser.

C. Approved 2" drawoff piping shall be provided on sprinkler risers with discharge piping running to open air.

D. Where sprinkler piping is trapped, an approved auxiliary draw-off shall be provided and neatly installed.

E. All draw-offs shall have a metal tag labeled "Sprinkler Drain."

6. INSPECTIONS AND TESTS

A. Furnish all labor, equipment and conduct all required tests in the presence of the Owner and Engineer or designated representative.

B. All piping and devices comprising the fire protection system shall be tested under hydrostatic pressure of not less than 200 PSI and maintained for not less than two (2) hours.

C. Upon completion of his work, the Contractor shall submit a written and signed certificate to the Engineers indicating that he performed the above prescribed tests and rectified all malfunctions arising there from.

D. Inspector's Test Locations:

(1) All test ports shall spill to the exterior of the building.
(2) None shall spill to the interior of the building or into mop sinks.
(3) Pipe so that test water does not drain to or splash on building finished materials or flatwork.
(4) Provide concrete splash blocks on grade to prevent erosion.

7. PERMITS

A. The Contractor shall obtain and pay for all necessary state, municipal, county, city and other permits and fees and pay all State taxes which are applicable.

8. GUARANTEE

A. All workmanship, equipment and material shall be guaranteed in writing against defects from any cause, other than misuse, for a period of one year after date of final acceptance.

9. ACCEPTANCE CERTIFICATE

A. Upon completion, the Contractor shall submit to the Engineers, a properly filled out "Sprinkler Contractor's Certificate Covering Materials and Tests." (4 copies).

10. CLEANING

A. Upon completion of this work all debris, material, and equipment shall be removed from the building and premises; all piping shall be cleaned ready for finish painting. Note: Do not remove rust inhibitive primer specified hereinafter.

11. PAINTING

A. All fire protection piping, fittings, etc., shall have one factory or shop coat of rust inhibitive primer. The Contractor shall thoroughly clean all such items in areas where the piping will be exposed so as to readily receive the finish coat specified in the Architectural Division of Painting. Colors shall be as specified in Identification Section of these specifications.

12. PIPE LAYING

A. Bell holes shall be excavated accurately to size and barrel of pipe shall bear firmly on bottom of trench throughout its length. All foreign matter and dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying. At times when pipe laying is not in progress, the open ends of pipe shall be closed by approved means, and no trench water shall be permitted to enter the pipe. Cutting of pipe, where necessary, shall be done in a neat and workmanlike manner, without damage to pipe. Refer also to Excavation.

13. EQUIPMENT AND MATERIALS

A. Signs

Appropriate code approved and required signs shall be installed on all control valves, drains, inspector's test, etc., indicating the function, installation, etc. Signs shall be neatly affixed with rust inhibitive screws, rivets or where hung from piping; with stainless steel No. 14 AWG wire.

B. Finish

All exposed materials such as valves, fire department connections, sprinkler heads, fire pump test headers, etc., shall be brass or chrome-plated brass.

C. Check Valves

(1) 2-1/2" and over; listed and approved by UL and FM; marked SV-FM; 175# working pressure; 1 BBM; flanged; equivalent to Mueller, Scott or Lunkenheimer.

(2) 2" and under; 150# working pressure; bronze; screwed; equivalent to Jenkins, Scott or Lunkenheimer.

D. Pipe & Fittings

(1) Nipples and fittings shall be of same material, composition, and weight classification as pipe in which installed.

(2) Up to 2" (Interior) Schedule 40 ASTM A-53 black steel; 125# cast iron screwed fittings or Schedule 10, ASTM A-135 black steel with victaulic or similar type approved fittings.

(3) 2-1/2" and larger (Interior) Schedule 40 black steel with flanged, welded or victaulic (or similar) type approved fittings or Schedule 10, ASTM A-135 black steel with victaulic or similar type approved fittings.

(4) Blazemaster or approved equivalent CPVC SDR 13.5 pipe UL listed for fire protection use. CPVC is not allowed for dry pipe systems and is only allowed in light hazard occupancies. Piping must be installed in accordance with the manufacturer's recommendation and all governing bodies having jurisdiction.

(5) Exterior: Class 200 PVC piping for exterior fire protection piping. Piping shall meet AWWA C900 requirements, be UL listed, Factory Mutual approved and NSF approved. Joints shall have spigot pipe ends with a flexible elastomeric ring seated in a groove to provide water tight seal. Minimum burst pressure to be 900 psi when tested in accordance with ASTM D1599. No. 8 copper wire (tracer wire) shall parallel all exterior PVC pipe.

(6) Dry Pipe System Piping: Same as standard system except Schedule 10 piping is not acceptable.

E. Clamps and Anchors

(1) Furnish and install approved clamps, as required, at all (45 degree) l/8 bends, (90 degree) 1/4 bends and flange and spigot pieces to the straight pipe to insure permanent anchorage of all fire lines. Clamps, clamp rods, nuts, washers, and glands shall be coated with a quick drying coal tar bituminous paint after installation.

F. Hangers

(1) All piping shall be adequately and permanently supported in an approved manner on approved hangers (Submit with drawings).

G. Sleeves and Escutcheon Plates

(1) Furnish and install sleeves for pipes where piping penetrates masonry walls; exterior wall sleeves to be watertight. Fire and smoke stop all penetrations through fire and smoke walls and coordinate with General Contractor for locations.

(2) Furnish and install cast brass chrome plated split ring type escutcheons where piping penetrates walls, ceilings and floors, whether in finished areas or not.

H. Electric Wiring

(1) All electric wiring for the system which may be required shall be installed in accordance with the National Board of Fire Underwriters, and National Electric Code. The cost of this electric wiring shall be included under this Contract. All electrical wiring and conduit installed in fire protection pits shall be sealed watertight.

I. Inspection Test Connections & Pressure Gauges

(1) A 1" inspection test connection as required by the Building Code. Discharge shall run to open air.

(2) Control valve for test connection shall be installed not over 7' above the floor.

(3) A pressure gauge at the inspection. Test connection at each location indicated on the Plans. Pressure gauges shall be 2-1/2" diameter and readable from the floor.

J. Gate Valves

(1) 2-1/2" and over; listed and approved by UL and FM; marked SV-FM; 175# working pressure; 1 BBM; OS&Y; flanged; cast iron discs; bronze seat rings; four point wedging mechanism; equivalent to Mueller, Scott or Lunkenheimer.

(2) 2" and under; 150# working pressure; bronze; rising stem; screwed; bronze discs; bronze seat rings; two point wedging mechanism; equivalent to Jenkins, Scott or Lunkenheimer.

K. Sprinkler Head Cabinet

(1) Furnish and install a cabinet, clearly labeled, with four (4) sprinklers of each type complete with required wrenches. Locate as directed by Engineer. Label "Sprinkler Heads."

L. Fire Department Connection

(1) Furnish and install a fire department connection with threads as approved by the local fire department; cast brass polished and chromium plated; with connection sizes and lettering as directed by the local authority having jurisdiction; Units shall be Acron Brass or equal single 4" nozzle, clapper, etc.

M. Siamese Hose Connection

(1) Furnish and install on the fire protection pit and on the roof where required by the local authority a siamese hose connections with threads as approved by the local Fire Department. Unit shall be similar to Larsen's No. 15 sidewalk siamese, size: 2-1/2" x 2-1/2" x 6". Coordinate threads type with local Fire Department.

N. Post Indicator Valve

(1) Furnish and install a post indicator valve as required by the local authority. It shall be listed and approved by Underwriters Laboratories and Associated Factory Mutual Laboratories; Marked SV-FM; vertical; non-adjustable; with electric supervisory switch, handle, view window, brass padlock with (2) keys; gate valve to meet gate valve specifications, except to have non-rising stem and mechanical joint ends; equivalent to Mueller, Scott or Lunkenheimer.

O. Detector Check Valve

(1) Furnish and install detector check valve as required by the local authority. It shall be listed and approved by Underwriter Laboratories and Associated Factory Mutual Laboratories; 175# working pressure; IBBM; flanged; with tapped bosses each side for by-pass meter trimming; equivalent to Viking, Badger or Grinnell.

(2) The Contractor shall contact the servicing water company and ascertain their policy pertaining to the by-pass water meter; if not furnished by water company. The Contractor shall furnish and install the by-pass meter and trimming as detailed on the drawings.

P. Sprinkler Heads

Gem, Grinnell, Star, Viking, Reliable, Central or approved equivalent as follows:

(1) Where piping is exposed: "Standard up right."

(2) Where piping is concealed above finished ceilings, provide two pieces, semi recessed, white plated sprinkler heads with removable escutcheon.

(3) Install sprinkler head guards where heads are subject to physical abuse. Heads located below seven (7) feet above floor, etc.

(4) Sprinkler head degree ratings shall be determined by the area serviced in accord with current Codes and Standard Practices. Indicate degree ratings on submitted Shop Drawings.

(5) The Contractor shall submit to the Engineer for inspection, one (1) sample of each type of sprinkler head, proposed to be used on the project.

(6) Where heads are installed in a tile ceiling, they shall be installed in the middle of the tiles, at half or quarter points along the length of the tiles. Install sprinkler heads at quarter points of center scoured 2' X 4' ceiling tiles.

(7) Provide high temperature heads around range hoods, kitchen equipment, kilns, boilers, water heaters and other heat producing equipment.

(8) Auditorium: Provide concealed heads.

Q. Water Motor Gong

(1) Furnish and install a water motor gong.

Grinnell, Viking, Mueller or equivalent.

R. Retard Chamber

(1) Same as water motor gong.

S. Flow Indicator Switches

(1) Furnish and install flow indicator switches as required by NFPA 13. All flow indicator switches shall be UL approved. Coordinate with Fire Alarm System supplier/installer. Provide a set of dry contacts on each flow switch for interface to the Control System if this control point is specified in the Controls Section.

T. Tamper Switches for Water Shut-Off Valves

(1) Furnish and install tamper switches where required by NFPA 13. All tamper switches shall be UL approved. Coordinate with fire alarm system supplier/installer. All tamper switches located in fire protection pits shall be waterproof, capable of operating beneath water similar to Potter PTS Series and be NFPA approved.

U. Fire Hydrant

(1) Furnish and install fire hydrants as approved by local Fire Department.

V. Reduced Pressure Backflow Preventer

(1) Refer to plumbing specialties section of these specifications.

W. <u>Fire Pump, House, and Storage Tank</u>

<u>INLINE FIRE (BOOSTER) PUMP</u>

Furnish 1 - vertical in-line fire pump as manufactured by the Patterson Pump Co. The pump shall be designed to deliver 450 GPM at total discharge pressure of 50 PSI. The pump shall conform to the requirements of NFPA 20, be UL listed and FM approved, and suitable for electric motor drive. The pump shall be a Patterson Model #5x3 VIP and shall have a 5” suction and a 3” discharge. The pump and driver shall be vertically mounted with the shaft close coupled to a bronze impeller. Pump will be packed with one packing gland and 5 rings of high speed graphite packing. Pump will include a 2” hand-hole clean out, per NFPA 20, on bottom of pump. Pump manufacturers without a hand-hole clean out will supply a strainer for mounting in the suction of the pump.

<u>ELECTRIC MOTOR</u>

1 - 20 HP, 3525 RPM, 460/60/3 phase open drip proof motor. Motor mounted vertically using a JP frame style

CONTROLLER

The electric motor controller shall conform to the requirements of NFPA 20 and be specifically approved for fire pump service. All control equipment shall be mounted on a drip proof moisture resistant housing and shall be labeled fire pump controller. The control equipment shall be completely assembled, wired, and factory tested. The starter shall be model #FT90-20D The controller shall be combined manual and automatic controller and shall automatically start the pump when the system pressure drops 10 PSI lower than the jockey pump setting. The circuit breaker shall be rated for 100,000 AIC at 460 volts.

AUTOMATIC TRANSFER SWITCH

The automatic transfer switch shall be an integral part of the main controller. The transfer switch shall be suitable for use with a second utility.

JOCKEY PUMP & CONTROLLER

Furnish 1 - pressure make-up pump. The pump shall be capable of delivering 10 GPM at a total net head of 71 PSI. The pump shall be close coupled to an ODP motor. The pump shall be Ebara EVMSU3-5. The pump shall operate automatically by utilizing a controller capable of automatic starting and stopping the pump through use of a pressure switch. The controller shall contain an across-the-line starter with a fusible disconnect switch, adjustable pressure switch, H-O-A selector switch, control circuit transformer. The motor and controller shall be suitable for operation on a 3 phase, 60 hertz, 460-volt power, motor shall be 1 HP, 3500 RPM.

FIRE PUMP FITTINGS

Pump manufacturer to supply the following fittings in accordance with NFPA 20, concentric discharge increaser, hose header, hose valves with caps and chains, suction control valve.

COUPLING ALIGNMENT

Coupling alignment is the responsibility of the pump supplier. Prior to grouting, a factory authorized representative shall check for parallel and angular alignments which shall be with 0.0004” T.I.R. per inch of radius.

START – UP

The fire pump manufacturer’s representative shall be licensed by the State of Ohio to supervise a fire pump acceptance test.

PRE-ASSEMBLED FIRE PUMP BUILDING

PART I - GENERAL
This section is for a “Pre-Assembled Pump Building” complete with all materials and

accessories as needed for a complete building as shown on the project drawings and as specified herein. All requirements of the contract documents, General Conditions, and Project Requirements apply to this section except as modified herein.

1.01 DESCRIPTION

A. The work shall include the furnishing, delivery, and installation of One (1) 14'L X 9'W X 10'T
pre-assembled, pre-engineered, steel building as specified herein.
B. The building shall be a structurally steel framed design.

DESIGN REQUIREMENTS

A. Codes and Standards. The structure design and manufacture shall, as a minimum, conform to ASCE
(American Society of Civil Engineers) current edition of "Minimum Design Loads for Buildings and
Other Structures" and to the MBMA (Metal Building Manufacturers Association) "Recommended
Design Practices Manual." Building shall be manufactured and built to satisfy current editions of
the International Building Code (IBC), and the National Electrical Code (NEC). Building
Manufacturer shall supply plans and calculations stamped by a Registered Professional Engineer for
the State where Building to be installed, and is responsible for obtaining any State Industrial Building
Commission Approvals and Third Party Inspections if required by the State where building is
installed.

B. Loading. The building shall be designed to support the following loads:
1. Roof Load - 50 PSF (40# live and 10# dead)
2. Ceiling Dead Load - 10 PSF
3. Wall Load - 110 mph wind, plus wall mounted equipment.
4. Floor Load – N/A Slab Floor
5. Seismic Zone: Per UBC for site location.

1.02 DRAWINGS AND SUBMITTALS
A. Within reasonable time of notice to proceed, the Manufacturer shall submit four (4) sets of Approval Drawings and an electronic file copy of same in AUTOCAD-2007 format to the engineer for review. The drawings shall show at a minimum the building floor plan, interior and exterior dimensions, elevations, suggested foundation elevations and dimensions, and the location of all primary accessories included with the building.

B. A standard color chart shall be provided to the Owner for exterior color selection prior to manufacturing.

C. A digital file of each final shop drawing shall be sent on disc or via E-Mail to the Engineer at the time of shipping and prior to request for final payment. Digital files shall be in AUTOCAD-2007 format or other approved computer graphics format.

1.03 QUALITY ASSURANCE

A. Building Manufacturer to have a Quality Control program that follows building through to

completion and is passed onto Owner with all instruction manuals and final drawings. Additionally,

the building manufacturer to have been in the control building business for a minimum of 5 years,

and able to supply proof of supplying at least 25 Buildings of a similar type in that time.

1.04 WARRANTY

A. Manufacturer shall guarantee that the complete building will have no defects in materials and workmanship for a period of 2 year, except as limited or extended by the original equipment or component manufacturer.

B. Metal Exteriors and Roofing shall have a 70% PVDF resin based paint coating, over a Galvalume substrate, with a Twenty Year Warranty against rust perforation, a Thirty Year Warranty against fading and chalking and a Forty Year Warranty against flaking peeling and checking. Coatings to meet minimum performance requirements as set forth in ASCA specification 96 and AAMA specification 2605. (KYNAR 500 is an approved coating).

PART II PRODUCTS

2.01 MATERIALS

A. The materials shall be new, unused, and fabricated in a workmanlike manner in a factory environment. Hot rolled steel to meet as a minimum standard ASTM –A36, and all galvanized steel

to meet as a minimum standard ASTMA -653.

B. The components and building parts shall be clearly marked on the drawings.

2.02 BASE - PERIMETER ANGLE SYSTEM

A. Building base shall have a hot rolled steel angle framework, welded, primed and painted, with maximum deflection of 1/8” in 10’ of length. Base shall be pre-drilled for anchoring to a Steel Skid. Steel floor/foundation to be by others with building weights supplied by building manufacturer.

A. Base framework to be fully cleaned, primed and painted with a self-priming, VOC compliant, catalyzed coating system designed to provide an extremely durable finish, suitable for heavy industrial, severe coastal, chemical, or off shore environments with superior corrosion protection and resistance to fading. Paint system to have a minimum Dry Film Thickness, per coat of 5 mils.

B. Weld standards shall, as a minimum, meet AWS recommended practices.

2.03 BUILDING

A. **Framework:** The building shall have a complete, internal, self-supporting, structural steel frame which does not rely on the exterior panels or roof cover panels for its structural strength or framing. The building framework shall include 8 to 16 gauge, cold-formed, galvanized steel structural members. Building framework to have a flush wall, post and beam format with girts and purlins, and full trusses on both endwalls which easily allows for future expansion and/or modifications. Wall and ceiling structural support system are to be designed to provide load carrying capability for anticipated equipment loads using 16 gauge galvanized steel hat channels behind liner panel for reinforcement as needed, with locations shown on approval drawings. Roof to have 8 to 14 gauge solid web hot rolled steel trusses.

B. **Insulation:** Exterior walls shall have a minimum of 3.5", fiberglass batt insulation and a vapor barrier. The ceiling shall have a minimum of 6" insulation and a vapor barrier. In addition to the insulation in the walls and ceiling, an additional 1" fiber-glass insulation blanket shall be installed over the entire building framework and under the exterior wall and roof panels, as a thermal break. The insulation system shall provide a minimum of R-14 in the walls, R-21 above the ceiling.

C. **Roof:** A roof pitched 1 inch in 12 or greater shall have a covering of overlapping, 26 gauge, "Multi-Rib" ribbed steel panels with a baked-on Kynar 500, PVDF resin-based finish over a galvalume substrate, in manufacturer's standard colors. Overlapping roof panels shall be installed with appropriate self-tapping fasteners with integral gaskets. A roof with a pitch of less than 1 inch in 12 shall have a roof covering of mechanically-seamed, 24 gauge, Standing-Seam Roofing, with a minimum seam height of 2". Standing seam roof panels shall be of Galvalume steel, with a baked-on Kynar 500, PVDF resin-based coating and shall have no visible fasteners on main run. Roof to include a matching, die-formed ridge cap, and a fully supported 3" overhang. Properly sized attic space ventilation shall be provided. Roof to be either a gable or one way slope with pitch as indicated on drawings. Heavy duty steel lift eyes to be supplied and mounted to the roof trusses as needed for lifting the building.

D. **Exterior Walls:** The exterior walls shall be 26 gauge "Multi-Rib" ribbed steel panels with a PVDF resin-based finish over a galvalume substrate in manufacturer's standard colors. Exterior siding panels to be overlapped and installed with appropriate self-tapping fasteners with integral gaskets, and shall be removable without any disturbance to interior panels. Butted seams are not allowed. All openings in walls are to be structurally framed, sleeved, trimmed, and provided with external drip caps. Repair or replacement of exterior panels must be able to be done entirely from outside.

E. **Exterior Trim:** The exterior trim package shall include stepped or boxed eave, rake, fascia, base, corner, jamb, and header trim in, 26 gauge Galvalume material with owner's choice of standard KYNAR colors.

F. **Interior Finish:** The building's interior walls and ceiling shall be lined with flush-fit 22 gauge, roll-formed liner panels, with concealed fasteners and a baked-on White polyester finish over G-90 galvanized substrate. The building interior shall feature a complete matching trim system including base, jamb, header, and ceiling trim. Liner to be reinforced with 14 gauge hat channels mounted vertically as needed for heavy wall mounted items.

G. **Interior Dimensions**: The building's finished interior dimensions shall be no less than 10 ½" in width and length from the exterior dimensions shown on the drawings. Minimum floor to ceiling dimension shall be nominal 7" less than stated eave height.

H. **Fasteners, Adhesives, and Sealants:** The fasteners, adhesives, and sealants utilized shall be of types approved for use on this type of structure as required by the appropriate agency or governing body, as covered in section 1.02 of these specifications.

I. **Closures:** Matching, pre-molded, closed cell elastomer closures provided by the siding and roof panel manufacturer shall be installed according to the manufacturer's recommendations at the eave line, beneath the roof panels, and where the trim meets the wall panels.

2.04 DOOR AND HARDWARE

A. **Minimum Standards**. Doors shall at a minimum comply with Steel Door Institute directive SDI-100.

B. **Doors and Frames.** Doors to be constructed of no less than 18-gauge steel faced leafs with stiffeners and 16 gauge door frames. Doors and frames to be hot-dipped galvanized to ASTM designations A924 and A653, then factory primed and painted with epoxy enamel to match the building or the trim. Door to have insulated core.

C. **Sizes and Quantity.** Shall be 72" X 84" Double type at a minimum or as indicated on the drawings.

D. Door Hardware shall include:

1. NRP stainless steel ball bearing hinges, minimum of Three (3) per door.
2. LCN4111 closer with hold open arm.
3. Weatherstripping and sweep, Reese #797B.
4. Threshold, Reese #V301.
5. Watershed, at top of door, Reese #202C; 203C.
6. Drip cap, extending 3" past door edge.

2.05 MISCELLEANEOUS BUILDING ACCESSORIES

A. **Gutters** 26ga - Mounts over Eave trim - Both Eave Walls with 2 down spout - 2' - with Type "A" Elbows

3.0 ELECTRICAL Single Point Connection. All wiring between equipment and panels must be prewired by the factory.

(1) 5 KW heater with thermostat.

(1) 16" exhaust fan and thermostat.

(2) 4' interior florescent lights

(1) Wall mounted convenience outlet.

(1) Lighting panel box with 7 1/2 KVA Transformer.

(6) 15 Amp single pole circuit breakers.

(1) Exterior weatherproof sodium vapor light.

(1) Motorized damper.

Emergency light

Exterior red rotating beacon

Tamper switches on gate valves. All butterfly valves are supplied with tamper switches as a standard.

14. GUARANTEE

A. All workmanship, equipment and material shall be guaranteed in writing against defects from any cause, other than misuse, or vandalism, for the warrantee period after substantial completion.

Fire Protection Storage Tank

Type: Double-wall Aboveground Horizontal

Construction : UL-142 Double-wall (Type I) Steel Storage Tank

Furnish and install a 30,000 gallon aboveground, horizontal, double wall (Type I), steel storage tank 10’6” inches in diameter by 46’6” long. Tank shall be fabricated from mild carbon steel with flat-flanged heads. Inner tank gauges: head gauge ¼”, shell gauge
¼”. Outer tank gauges: head gauge 7, shell gauge 7. All items included with the tank shall be coated with red oxide primer. The tank shall be manufactured in conformance with Underwriters Laboratories' UL-142 specifications and so labeled.

The tank shall be fabricated with the following threaded connections : 2 4 inch as located on attached drawing.

Flange sizes as follows (qty-size): 3-4”with locations also indicated on drawing. (See standard fittings drawing (STDFTG) for quantity, size and locations). Thread protectors shall be inserted in all threaded openings prior to shipment.

Highland tanks are air tested at the factory but MUST be retested at the jobsite by the installer prior to installation.

Options & Accessories:

2 Manway(s) 24 ¼” inches in diameter with bolted and gasketed lid
4 Support Saddles per drawing
1 Emergency Vent
1 External Ladder
1 External Ladder & Platform
1 Exterior urethane paint White
1 Internal coating HighDRO Liner Plus (Must include interior weld. Minimum size 500 gallon.)

Warranty:
The subject tank is warranted by Highland Tank & Mfg. Co. to be free from defects in manufacturing, workmanship and materials. Highland Tank will repair or replace, at its sole discretion F.O.B. factory, within a period of one year after date of shipment, any item of our manufacture. All other items shall be warranted by their respective manufacturers. Liability hereunder is limited, as stated above, and does not include labor, installation costs, indirect or consequential damages of any kind. Tanks must be returned to the factory and if found to be defective upon examination, will be repaired, replaced or credit will be issued at our option.
Approved Manufacturer:
Tank to be manufactured by Highland Tank at one of the following locations: Stoystown, PA; Manheim, PA; Watervliet, NY; or Greensboro, NC.

END OF SECTION 21 01 00

SECTION 22 01 00 - PLUMBING SPECIALTIES

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work specified in this section.

   B. The Contractor shall provide all equipment and specialties complete with trim required and connect in a manner conforming to the international plumbing code.

   C. The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of his rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.

   D. Prior to final inspection, test by operation at least twice, all equipment.

   E. Prior to final inspection, remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from equipment and specialties and thoroughly clean same.

   F. All equipment and specialties shall be installed as recommended by the manufacturer in a neat and workmanlike manner. Unacceptable workmanship shall be removed and replaced at the installing Contractor's cost.

   G. All pipes, valves, fittings, fixtures, etc. for use in potable water systems 2” and below shall comply with federal lead free requirements that the lead content of wetted surfaces cannot exceed 0.25% by weight.

2. DRAINAGE SPECIALTIES

   A. GENERAL

      (1) Provide all drainage specialties indicated, specified and/or required to provide complete and acceptable removal of all storm, sanitary, waste, laboratory waste, etc. from the building and into approved receptors.

      (2) Drainage specialties shall be on non-electrolytic conduction to the material to which they are connected.

      (3) Drainage specialties shall be installed in a manner so as to insure no leakage of toxic or odorous gases or liquids and shall have traps and/or backflow preventers where required. Nor shall they allow backflow into other or existing systems.

   B. CLEANOUTS - INTERIOR (CO)

(1) In addition to cleanouts indicated, provide cleanouts in soil and waste piping and storm drainage at the following minimum locations:

a. At base of each stack.
b. At fifty (50) foot maximum intervals in horizontal lines.
c. At each change of direction of a horizontal line.
d. As required by current plumbing code
e. As required to permit rodding of entire system. (If in doubt, contact Engineers.)

(2) Water closets, slop sinks and other fixtures with fixed traps shall not be accepted as cleanouts.

(3) Cleanouts and/or test tees concealed in inaccessible pipe spaces, walls and other locations shall have an eight (8) inch by eight (8) inch (minimum) access panel or cover plates shall be set flush with finished floors and walls and shall be key or screw driver operable.

(4) Access panels for cleanouts shall be of the Zurn, 1460 series or equivalent by Josam or Watts. Where they are not to receive paint, they shall be polished bronze unless otherwise indicated where they are to receive paint or other finishes. They may, at the Contractor's option, be Perma-Coated steel, prepared to receive finish.

(5) Cleanouts and access panels shall be sized so as to permit the entry of a full sized rodding head capable of one hundred percent circumferential coverage of the line served.

(6) Provide a non-hardening mixture of graphite and grease on threads of all screwed cleanouts during installation.

(7) Do not install cleanouts against walls, partitions, etc. where rodding will be difficult or impossible. Extend past the obstruction.

(8) In finished walls, floors, etc., insure that cleanouts are installed flush with finished surfaces and, where required, grout or otherwise finish in a neat and workmanlike manner.

(9) Cleanouts shall be as manufactured by Zurn, Josam, Jay R. Smith, Watts, MIFAB, Ancon or equivalent, similar to the following:

a. Zurn, Z-1440 cleanouts or Z-1445 cleanout tee at base of exposed stack and at change in direction of exposed lines.

b. Zurn, Z-1440 cleanout or Z-1445-1 cleanout tee where stacks are concealed in finished walls

c. Zurn, ZN-1400-T cleanout with square scoriated top in finished concrete and masonry tile floors.

d. Zurn, ZN-1400-Tx cleanout with square recessed top for tile in vinyl and linoleum finished floors.

e. Zurn, ZN-1400-Z cleanout with round recessed top for terrazzo floors.

f. Zurn, Z-1400-HD cleanout with tractor cover for exterior locations. Provide concrete supporting pad crowned to shed water. Refer to drawings for pad size.

g. Mueller, No. D-731 or D-714, Nibco, Flage or equivalent for cleanouts in copper waste with cover plates and/or access panels listed for other cleanouts.

h. Threaded hex head type cleanouts of same materials as pipe for piping 2" and smaller.

i. Zurn, cleanout with round top with adjustable retainer for carpet area. Install flush with carpet.

C. FLOOR DRAINS

(1) Provide floor drains at locations indicated and/or as required by plumbing code. Install in a neat and workmanlike manner. Coordinate locations with appropriate persons or party to insure floor pitch to drain where required.

(2) Install floor drains in strict accordance with manufacturer's recommendations plumbing code unless otherwise indicated.

(3) Each floor drain located on floors above the lowest floor shall be provided complete with a three (3) foot by three (3) foot, four (4) pound sheet lead flashing and clamping collar or chlorinated polyethylene shower pan liner of 30 mil. Lead pans shall be given a heavy coat of asphaltum on bottom and sides before installation and a heavy coat on exposed surfaces (if any). After installation, provide one ply of fifteen (15) pound roofing felt beneath each pan.

(4) Insure by coordination with the appropriate persons or party that spaces served by a floor drain(s) has a water seal extending at least three (3) inches from the floor of the space served on all floors above the lowest level.

(5) The floor drains shall be Zurn, Josam, Watts,Jay R. Smith, MIFAB, Sioux Chief or equivalent.

D. CLEANOUTS (EXTERIOR) (ECO)

Provide exterior cleanouts at each location indicated and in the manner indicated. Permanently set all exterior cleanouts centered in a 30" X 30" X 6" deep concrete pad. The top of the concrete pad shall be flush with finished grade. The top of the cleanout box shall be flush with the top of the pad and shall be stamped "CO."

E. ROOF DRAINS

(1) Each drain shall be provided complete with a three (3) foot by three (3) foot, four (4) pound sheet lead flashing and clamping collar. Roof drains shall be installed in strict accordance with the drain manufacturers and roofing manufacturer's instructions. Provide all accessories required for a complete installation.

3. WATER SUPPLY SPECIALTIES

A. GENERAL

(1) Provide all water supply specialties indicated, specified and/or required for the complete installation. Install in a neat and workmanlike manner in accordance with the manufacturer's recommendations and plumbing code

(2) Where required by the plumbing code, install code approved vacuum breakers in each water supply specialty.

B. FREEZEPROOF WALL HYDRANTS (FPWH)

(1) Provide code approved wall hydrants at each location indicated in a neat and workmanlike manner. Affix tight to walls and insure that the feed piping is on the heated side of the building insulation blanket.

(2) Where hydrants are of handwheel type, remove handwheels and turn over to owners in an envelope labeled "Wall Hydrants" exterior upon completion of the project.

(3) Where hydrants have key operators, turn over at least two (2) keys in an envelope labeled "Wall Hydrants" to owners upon completion of the project.

(4) Where hydrants have lockable boxes, turn over at least two (2) keys in an envelope labeled "Wall Hydrants, Exterior" to owners upon completion of project.

(5) Mount all wall hydrants at least twenty (20) inches above finished exterior grade. Where this is not possible or practical, contact Engineers.

(6) Wall hydrants shall be as follows or equivalent:

a. Zurn 1300 or equivalent, 3/4", encased, flush, non-freeze wall hydrant with key lock and combination backflow preventer/vacuum breaker.

C. HOSE BIBBS (HB)

(1) Provide code approved hose bibbs with vacuum breakers and male threaded spouts at each location indicated and as follows:

(2) Do not install hose bibbs spaces which do not have existing planned or installed floor drains even if sill cocks are indicated for these areas.

(3) Hose bibbs shall be mounted at eighteen (18) inches above finished floor served.

D. BOILER DRAINS (BD)

Install 3/4 inch bronze body boiler drains, similar and equivalent to Nibco, No. 72 or 73, as indicated and at the following locations:

(1) At the low point of the plumbing system.

(2) In each hot water heater and/or storage tank.

(3) At the low point of each hydronic system.

(4) On each water storage tank.

(5) At each pump suction.

(6) At the low point of each isolatable section of any system carrying water.

NOTE: Install a code approved vacuum breaker where installation on to domestic water system.

E. WATER HAMMER ARRESTORS (WHA): Provide water hammer arrestors at each location indicated and/or as required to eliminate hydrostatic on the domestic water system. Provide at least one water hammer arrestor at all quick acting valve locations including:

Automatic Clothes Washers – Type “A”
Commercial Dishwashers – Type “B”
Mop Basins (downstream of check valve) – Type “A”
Flush valve fixtures - Type “B” (Each toilet room with 1-3 flush valve fixtures shall have its own Type “B” water hammer arrestor.)

(1) Multiple Fixtures – Branch Line Less Than 20’ Long: The preferred location for a Zurn Shoktrol is at the end of the branch line between the last two fixtures when the branch lines do not exceed 20’ in length, from the start of the horizontal branch line to the last fixture supply on this line.

(2) Multiple Fixtures – Branch Line More Than 20’ Long: On branch lines over 20’ in length, use two Shoktrols whose capacities total the requirement of the branch. Locate one unit between the last and next to last fixture and the other unit approximately midway between the fixtures.

(3) Water hammer arrestors shall be Zurn, Z-1700, Shoktrol, Smith, Josam, Wade, or equivalent. Water hammer arrestors shall be stainless steel, bellows type. Field fabricated capped cylinders shall not be acceptable.

(4) Note: Provide insulation unions where arrestors are of dissimilar material from the piping served (unless piping is non-conducting, such as ABS or PVC).

MARK	MANUFACTURER & MODEL	SIZE	P.D.I. SIZE
TYPE "A"	ZURN, Z-1700 # 100	1-11	A
TYPE "B"	ZURN, Z-1700 # 200	12-32	B
TYPE "C"	ZURN, Z-1700 # 300	33-60	C
TYPE "D"	ZURN, Z-1700 # 400	61-113	D

F. PRESSURE REDUCING VALVES (PRV)

Install at each location indicated and/or as required to reduce domestic building water service to a maximum of eighty (80) PSIG code approved pressure reducing stations with by-pass. Install in a manner indicated or as required. Provide unions and stops for removal of station. PRV shall be adjustable from thirty (30) percent above or below reduced pressure. Where this cannot be attained with single stage, provide multiphased reduction.

G. REDUCED PRESSURE BACKFLOW PREVENTERS (RPBP)

Watts #909 or equivalent reduced pressure backflow preventer. Provide with gate valves for isolation, FDA food grade strainer and air gap fitting. RPBP shall be UL listed.

4. GENERAL SPECIALTIES

A. VACUUM BREAKERS AND BACK FLOW PREVENTERS

Where required by the plumbing code, whether indicated or not, provide approved vacuum breakers or backflow preventers at the following locations.

(1) Where domestic water system connects to fire protection system.
(2) Where domestic water system connects to hydronic system.
(3) At any hose (threaded) tap on the domestic water system.

B. ROOF FLASHINGS

All plumbing vents or other plumbing passing thru the roof shall be flashed as approved by the plumbing code and as recommended by the roofing manufacturer and/or Contractor.

PART 1 - EXECUTION

1.1 GENERAL

A. Provide sleeves wherever piping or electrical wires are placed under paved surfaces.

B. Lay out work as accurately as possible to Drawings. Drawings are diagrammatic to the extent that swing joints, offsets, and fittings are not shown.

C. Sleeves are required wherever piping or electrical wires are placed under paved surfaces.

D. Where piping is shown on drawings to be under paved areas but running parallel and adjacent to planted areas, the intent is to install piping in planted areas. Do not install directly over another line in the same trench.

E. It shall be the Contractor's responsibility to establish the location of all sprinkler heads in order to assure proper coverage of all areas. In no case shall spacing of sprinkler heads exceed distances shown on the drawings and/or those specified. Pipe sizes shall conform to those shown on drawings. No substitution of smaller pipe sizes will be permitted, but substitutions of larger may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of said rejection.

1.2 EXCAVATING AND BACKFILLING:

A. All piping is to be trenched.

B. Excavate to depths required to provide two inches depth of sand bedding material for piping when unsuitable bearing materials are encountered.

C. Should utilities not shown on the plans be found during excavations, the Contractor shall promptly notify the Owner's Authorized Representative for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities. Indicate such utility crossings on the record drawings promptly

D. Perform all excavations as required for installation of work included under this Section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations, to their original condition.

E. Trenches shall be open, vertical sided construction wide enough to provide free working space around work installed and to provide adequate space for backfilling and compacting.

F. When two pipes are to be placed in the same trench, a six-inch space is to be maintained between the pipes. The Contractor shall not install two pipes with one directly above the other.

G. The Contractor shall cut trenches for pipe to required grade lines and compact trench bottom to prove accurate grade and uniform bearing for the full length of the line.

H. The Contractor shall be held responsible for damages caused by these operations and shall immediately repair or replace damaged parts.

1.3 PIPE LINE ASSEMBLY

A. General
1. Install pipes and fittings in accordance with manufacturer's latest printed instructions.
2. Clean all pipes and fittings of dirt, scales and moistures before assembly.
3. All pipe, fittings and valves, etc., shall be carefully placed in the trenches. Interior of pipes shall be kept free from dirt and debris and when laying is not in progress, open ends of pipe shall be closed by approved means.

B. Solvent-Welded Joints for PVC Pipe 3" and Smaller
1. Use solvents and methods approved by solvent and pipe manufacturers.
2. Cure joint a minimum of one hour before applying any external stress on the piping and at least 24 hours before placing the joint under water pressure, unless otherwise specified by the manufacturer.

C. Laying of Pipe
1. Pipes shall be bedded in at least in at least two inches of finely divided material with no rocks or clods over one inch diameter to provide a uniform bearing.
2. Pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction. One additional foot per 100 feet of pipe is the minimum allowance for snaking.
3. Do not lay PVC pipe when there is water in the trench.
4. All plastic to plastic joints will be solvent-weld joints or slip seal joints. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.

1.4 PVC SLEEVES

A. .Coordinate sleeving efforts with General Contractor.

B. All PVC sleeves shall be a minimum of twice (2x) the diameter of pipe to be sleeved.

1.5 QUICK COUPLING VALVES
1. Shall be set a minimum of twelve inches outside field of play or as otherwise noted. Quick coupling valves shall be housed in 10" valve boxes.
2. Valves shall be installed on a three-elbow PVC Schedule 80 swing joint assembly.
3. Provide six-inch (deep) layer of washed gravel below the bottom of the valve. Top of quick coupler valves shall be as close to the top of the valve box as possible. Top of gravel layer shall be three inches below the top of the valve.
4. Quick coupling valves shall be set perpendicular to finished grade unless otherwise designated on the plans.

1.6 VALVE BOXES

A. Valve boxes shall be set flush with grade in all areas.

B. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the valve box.

C. \

1.7 CONTROL WIRING

A. All electrical equipment and wiring shall comply with local and state codes and be installed by those skilled and licensed in the trade.

B. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines whenever possible, and shall have a minimum of twelve inches cover.

C. Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of twenty feet.

D. An expansion curl shall be provided within three feet of each wire connection and at least every one hundred feet of wire length on runs of more than one hundred feet in length. Expansion curls shall be formed by wrapping at least five turns of wire around a one-inch diameter pipe, then withdrawing pipe.

1.8 CLOSING OF PIPE AND FLUSHING OF LINES

A. All testing shall be done under the supervision of the Owner's Authorized Representative. Submit written requests for inspections to the Owner's Authorized Representative at least three days prior to anticipated inspection date.
   1. Thoroughly flush out all water lines under a full head of water before installing heads, valves, quick coupler assemblies, etc. Maintain flushing for a minimum of three minutes at the valve located furthest from water supply.
   2. After flushing, cap or plug all openings to prevent entrance of materials that would obstruct the pipe or clog heads. Leave in place until removal is necessary for completion of installation.
   3. Test as specified below.
   4. Upon completion of testing, complete assembly and adjust sprinkler heads for proper distribution.

1.9 TESTING

A. Make hydrostatic when welded PVC joints have cured as per manufacturer's instructions.
   1. Pressurized mainlines:
      a. Completely install water meter, mains, isolation valves and control valves. Do not open laterals.
      b. Open all isolation valves.
      c. Fill all lines with water and shut off at meter.
      d. Pressurize the main to 70 PSI. Monitor gauge for pressure loss for a minimum of four hours.
      e. Leave lines and fittings exposed throughout testing period.
      f. Leaks resulting from tests shall be repaired and tests repeated until the system passes.
      g. Test all isolation valves for leakage.

B. Non-pressurized laterals:
      a. Test piping after laterals and risers are installed and system is fully operational.

1.10 INSPECTIONS

A. The contractor shall maintain proper facilities and provide safe access for inspection to all parts of the work.

B. If the specifications, the Owner's Authorized representative's instructions, laws, ordinances or any public authority require any work to be tested or approved, the contractor shall give the Owner's Authorized Representative three days' notice of its readiness for inspection.

C. The contractor shall be solely responsible for notifying the Owner's Authorized Representative where and when such work is in readiness or testing.

D. If any work should be covered up without the approval of the Owner' Authorized Representative it must be uncovered, if required, for examination at the contractor's expense.

E. No inspection will commence without "Record" drawings and without completing previously corrections, or without preparing the system for inspection.

1.11 BACKFILLING AND COMPACTING

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches.

B. Backfill for all trenches, regardless of the type of pipe to be covered, shall be compacted to minimum 95 percent density under pavements, 85 percent under planted areas.

C. Backfill material shall be suitable material. Unsuitable material, including clods and rocks over two inches in size shall be removed form the site.

D. A fine granular material shall be placed initially on all lines with a minimum of three inches cover. No foreign matter larger than one-half inch in size shall be permitted in the initial backfill.
   1. Trenches located under paving shall be backfilled with sand (a layer six inches below the pipe and three inches above the pipe) and compacted in layers of 95 percent compaction.
   2. Compact trenches in areas to be planted, by thoroughly flooding the backfill.
   3. Surplus earth remaining after backfilling shall be disposed of off-site by the contractor.

1.12 CLEANING AND DISPOSAL OF WASTE MATERIAL

A. Perform clean-up during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment as fast as it accumulates.

B. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.

END OF SECTION 22 01 00

SECTION 22 02 00 - PLUMBING FIXTURES, FITTINGS AND TRIM

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. The Contractor shall provide all fixtures complete with trim required and connect in a manner conforming to the State Plumbing Code.

C. The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of his rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.

D. All exposed piping or in casework below sinks, stops, traps, tailpieces, etc., shall be code approved chrome plated brass unless otherwise indicated or specified. Water supplies shall connect through walls with stops and chrome plated escutcheons with set screws.

E. All fittings, fixtures and trim shall be new unless otherwise indicated or specified. They shall also be of equivalent quality, dimensions, material, etc. as those specified. All faucets, shower heads, drains, levers, trim, etc. shall be constructed of metal and not plastic.

F. Handicapped fixtures shall be mounted as recommended by the plumbing code and ADA.

G. All fixtures shall be mounted as recommended by the manufacturer. Fixtures shall be rigidly mounted to walls and floors. Pay particular attention to flush valves and bracket concealed portion to building structure during rough-in. Loose, shaky flush valves, lavatories, etc. shall not be acceptable.

H. Prior to final inspection open all faucets and allow to run for fifteen (15) minutes, then remove all faucet aerators and thoroughly clean until smooth flow is obtained.

I. Prior to final inspection, test by operation at least twice:

(1) (Where applicable) adequate flow of hot and/or cold water at;

a. Shower Heads
b. All Faucets
c. Flush Valves
d. Tub Drains
e. Hose Bibbs
f. Sill Cocks
g. All Other Valved Hot and/or Cold Water Openings In the Plumbing System

(2) All toilet seats

J. Prior to final inspection, remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from plumbing fixtures and thoroughly clean same.

K. All sink and lavatory traps shall have screw in plugs in the bottom for ease of cleaning and have mechanical fittings for ease of removal.

L. All fixtures shall be set level and true and shall be grouted into finished walls, floors, etc. in a neat and workmanlike manner with an approved waterproof non-yellowing grout for such service.

M. Special Note for Handicap Grab Rails: Coordinate top of shower valves, flush valves, flush tank, etc., with location of grab rails as shown on the architectural plans. The Contractor shall install all items to allow for installation, removal and service without removal of the grab bar.

N. All exposed drain pipes and domestic water piping under handicap accessible sinks and lavatories shall be insulated in accordance with ADA requirements and shall have a vinyl plastic covering over all insulation.

O. The Contractor shall obtain a copy of the casework shop drawings and confirm sinks, faucets, gas turrets, etc., will fit in the space provided. Additionally, in ADA applications with handicap sink base cabinets, the Contractor shall limit the total distance from the bottom of the sink to the bottom of the P-trap and coordinate waste pipe rough-in height to ensure the proper installation of the handicap sink base cabinet front closure panel. The Contractor shall not order sinks until he confirms no conflicts occur and shall adjust sink sizes if required. If the Contractor orders sinks, faucets, etc., that do not fit in the casework supplied, he shall replace them at no additional cost.

P. All lavatories, sinks, etc. shall be supplied with center rear drain outlets where necessary to avoid conflict with casework, handicapped kneeboards, etc. If the Contractor orders sinks that do not fit in the casework supplied, he shall replace them at no additional cost.

Q. All single supply faucets shall be provided with mechanical mixing valves unless otherwise noted. Mechanical mixing valves shall have hot and cold water inlet connections, common outlet, in-line check valves, and adjustable temperature setting. Mixing valves shall be Moen model 104424 or equal. Provide one mixing valve per single supply faucet unless otherwise noted. Contractor shall provide all required connections and set mixing valve to required temperature.

R. All gooseneck faucets shall have rigid spouts, unless swing spouts are specified. If swing spouts are specified, the spout shall have a maximum swing of 140 degrees from side to side.

S. All plumbing fixtures shall comply with federal lead free requirements.

T. All water closet handles on ADA water closets shall be located on the approach side of the fixture.

2. FIXTURES AND TRIM

A. Available Manufacturers: Subject to compliance with requirements of manufacturers offering plumbing fixtures and trim. Plumbing fixtures and trim, which may be incorporated in the work include, but are not limited to the manufacturers listed on the schedule on the drawings.

3. KITCHEN, LAB, SCIENCE ROOM FIXTURES, SPECIAL EQUIPMENT, ETC.

A. Contractor to provide final plumbing connections to all of the equipment furnished by Owner including, but not limited to: chrome supplies, stops, continuous drains, drain tailpiece, Plumbing Code "P" traps and escutcheons.

4. FIXTURE SELECTION

A. Refer to drawings for fixture schedule.

END OF SECTION 22 02 00

SECTION 22 03 00 - PLUMBING EQUIPMENT

1. GENERAL

   A. All plumbing equipment shall comply with the latest provisions of Plumbing Code.

   B. Provide magnesium anodes for water heaters and storage tanks.

2. WATER HEATER

   A. Refer to water heater schedule on plan sheets.

3. EXPANSION TANK (DOMESTIC WATER)

   A. Amtrol Therm-X-Trol ST-25V expansion tank, 10.3-gallon tank volume, pre-charged air chamber, stainless steel connection and heavy-duty butyl diaphragm.

4. SUMP PUMPS

   A. Weil, Zoeller, or approved equivalent 1-1/4" submersible sump pump, 5 GPM at 24 ft. TDH, 1750 RPM, 1/3 HP, 115-volt single phase. Furnish with mercury switch level control. Provide with light duty iron grate to cover sump pit opening, completely.

5. RECIRCULATING DOMESTIC HOT WATER PUMPS

   A. Thrush, Armstrong, Bell and Gossett or approved equivalent all bronze in-line centrifugal circulating pump with mechanical seals, drip proof motor and all required overloads, starters and disconnects.

END OF SECTION 22 03 00

SECTION 23 02 00 - HVAC EQUIPMENT AND HYDRONIC SPECIALTIES

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

B. The Contractor shall provide in complete working order the following heating, ventilation and air conditioning equipment located as indicated and installed, connected and placed in operation in strict accordance with the manufacturer's recommendations. All equipment shall be factory painted and, where applicable, factory insulated and shall, where such standards exist, bear the label of the Underwriters Laboratory.

C. Each subcontractor shall be responsible for their own completion of System Verification Checklists/Manufacturer’s Checklist.

D. Provide phase monitoring protection on all 3 phase equipment. All motors shall include factory installed phase monitoring if available. If Phase monitoring is not available from the factory the contractor shall provide PRsense PMRU-2C. Coordination installation of phase monitor with the electrical contractor.

E. Factory startup is required for all HVAC equipment. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians and shall complete and submit start-up reports/checklists. This shall include air handling units, boilers, chillers, cooling towers, VFDs, etc.

F. All HVAC equipment shall comply with the latest provisions of ASHRAE Standard 90 and/or International Energy Conservation Code, whichever is more stringent.

G. Installation of all heating, ventilating and air conditioning systems shall be performed by a master HVAC contractor licensed in the state the work will be performed.

H. Note to Suppliers and Manufacturers Representative furnishing proposals for equipment for the project:

(1) Review the Controls Section of these Specifications (if applicable) to determine controls to be furnished by the equipment manufacturer, if any. The Contractor shall provide all controls with equipment unless specifically listed otherwise.

(2) Review the section of these specifications entitle: REQUIRED SHOP DRAWINGS, DESCRIPTIVE LITERATURE, MAINTENANCE MANUALS, PARTS LISTS, SPECIAL KEYS, TOOLS, ETC., and provide all documents called for therein.

(3) Insure that the equipment which you propose to furnish may be installed, connected, placed in operation and easily maintained at the location and in the space allocated for it.

(4) Determine from the Bid Documents the date of completion of this project and insure that equipment delivery schedules can be met so as to allow this completion date to be met.

(5) Where manufacturers' temperature controls are specified, they shall be in full compliance with International Mechanical Code Section 606 including automatic smoke shut down provisions.

(6) Provide factory start-up on site by a factory representative (not a third party contractor) for all HVAC equipment, including pumps, VFDS, heat pumps, outside air units, etc. Submit factory start-up reports to the Engineer.

(7) Provide training to the Owner by a factory representative for each type of equipment. Training shall be a minimum of (2) two (8) eight hour days on site and the Engineer shall be notified one (1) week in advance of the training. Training shall only occur when the systems are complete and 100% functional. All training shall be videotaped. One day shall be near substantial completion and second day (1) one month prior to warrantee end.

(8) Review the Section on Motor Starters and Electrical Requirements for Mechanical Equipment.

(9) Requirements for motors controlled by variable frequency drives:

a. All motors shall be inverter duty rated.

b. Motors less than 100 HP in size shall be furnished with shaft grounding kit, Aegis SGR Bearing Protection Ring or equal. One shaft grounding ring and related hardware shall be provided on drive end or non-drive end of motor per manufacturer's instructions. These shall be factory mounted and installed on the exterior of the motor to allow for visual inspection. Ground motor frame per manufacturer's instructions. Install kit in strict accordance with manufacturer's instructions.

(10) Type 1 kitchen exhaust hoods shall be provided with a heat sensor to enable the exhaust and make-up air system automatically upon detection of heat.

(11) Equipment incorporating energy recovery wheels shall be provided with an aluminum wheel with molecular sieve desiccant, synthetic fiber wheels are acceptable. Wheels shall be certified in accordance with ASHRAE 84 or ARI 1060 standards.

(12) All condensate producing equipment shall be provided with a condensate trap as recommended by the equipment manufacturer and a condensate overflow switch.

(13) Provide low ambient and all required controls and accessories on all HVAC equipment to ensure they can provide cooling during the winter season.

(14) Provide a complete air tight enclosure with opening door that seals air tight for all filters on air moving equipment.

(15) All equipment shall be furnished for a single point electrical connection unless specifically excluded as a requirement.

(16) VAV Acceptable manufacturers include

a. Price
b. Nailor
c. Enviro-tec

(17) Mini-split acceptable manufacturers include:

a. Daikin
b. Trane
c. Mitsubishi
d. Samsung.

(18) Provide extra stock of the following in the quantities listed. Coordinate exact location of where this extra stock will be stored with the owner before delivery.

(2) VHP-24 Heat Pumps
(2) RP-1 Hot water recirculation pumps
(2) P-1 Flush valves
(2) P-3 Lavatory Faucet battery powered
(2) P-3 Lavatory Faucet hard wired.
Provide butt fusion joiner for piping sizes 2” and smaller to the owner.

A. R32 RF is acceptable. Refrigerant leak monitoring system is required on all heat pumps and oa units

PART 1 GENERAL

2. EQUIPMENT

B. **WATER SOURCE HEAT PUMPS (6- 25 Tons)** SECTION INCLUDES

A. Water-Source Heat Pumps.
B. Controls.
C. Accessories.

1.02 REFERENCES

A. ANSI/AHRI/ASHRAE/ISO13256-1 Performance for Water-Source Heat Pump Equipment.
B. CSA C22.2 No. 186.1 Central Forced Air Unitary Heat Pumps with or without Electric Resistance Heat.

C. AHRI 260 - Sound rating of ducted air moving and conditioning equipment.

1.03 SUBMITTALS

A. Submit unit performance data including: capacity, nominal and operating performance.
   1. Include rated capacities, furnished specialties, and accessories for each model.
B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Include diagrams for power, signal, and control wiring.
D. Manufacturer shall provide a paragraph by paragraph specification review with the product submission detailing compliance with or deviation from the specifications. Submittals without specification review will be returned un-reviewed.
E. Submit operation and maintenance data including manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data to include parts list and wiring diagrams.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products per manufacturer's recommendations.
B. Comply with manufacturers installation instructions for rigging, unloading and transporting units.
C. Unit shall be protected from physical damage and in compliance with LTL Rule 180
D. Leave factory shipping covers in place until installation.

1.05 WARRANTY

1.06 Provide Whole Units Parts Warranty for the duration of one year from substantial completion. Units shall come with a 5-year compressor part warranty. Warrant that all products are free from defects in material and workmanship and have the capacities and ratings set forth in manufacturer's catalogs and bulletins.

1.07 MAINTENANCE AGREEMENT

A. Furnish complete service and maintenance of units for one year from Date of Substantial Completion.
B. Provide maintenance service as outlined in manufacturer's operating and maintenance data.
C. Submit copy of service call work order or report and include description of work performed.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with documented experience.

PART 2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Trane
   2. Climate Master
   3. Daikin International
   4. Water Furnace
B. Description: Packaged water-source heat pump with temperature controls; factory assembled, tested, and rated according to ASHRAE/AHRI/ISO-13256-1.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
2. Products shall be designed, rated, and certified in accordance with ISO-AHRI 13256-1. Units shall meet the efficiency standards of the ASHRAE 90.1
3. Products shall be designed, rated and certified in accordance with ETL, CETL and ISO-AHRI 13256-1. Units shall meet the efficiency standards of the ASHRAE 90.1

C. GENERAL UNIT DESCRIPTION

1. The unit frame shall be constructed of zinc coated, heavy-gauge, galvanized steel. The panels are acoustically insulated with ½ inch: foil faced insulation with no exposed edges to prevent glass fiber in the airstream. The insulation shall be UL listed and meets NFPA-90A and UL 181 standards.
2. The manufacturer's maintenance instructions shall describe the proper cleaning procedure for the unit. Access for inspection and cleaning of the unit drain pan, coils and fan section shall be provided. The unit shall be installed for proper access. Procedures for proper access, inspection and cleaning of the unit shall be included in the maintenance manual.
3. All units shall be factory test operated prior to shipping
4. Vertical units shall have either Top or Back supply-air with Left or Right return-air.
5. Units shall be provided with 2” MERV8 filter
    a. A ducted filter rack shall be factory mounted for the use of 2 inch 2x2 filters and shall provide easy access to the filters from the side of the filter rack through a door that does not require a tool. Duct collars will be built into the filter rack to provide an easy means to connect the duct work to the unit. Refer to heat pump detail. Must accommodate 24x24x2” merv 8 filters
6. Drain Pan

    a. A stainless steel unit drain pan shall be provided. The stainless steel material shall meet the requirements of ASTM A480/A480M and comply with the chemical composition requirements of ASTM A240-304. The drain pan shall be insulated to prevent moisture accumulation on the drain pan material. The drain pan insulation material shall be suitable to be used in the airflow and consists of closed cell elastomeric insulation, complying with flammability requirements of UL94-5V
    b. The unit as standard will ship with a solid state electronic switch or manufacturer’s standard condensate overflow switch complying with UL 508.
    a. All hydronic coils are copper tube and aluminum plate fin combination. All coils shall be proof and leak tested from the manufacturer. The proof test shall be performed at 1.5 times the maximum operating pressure and the leak test at the maximum operating pressure.
    b. A dual sloped noncorrosive drain pan is easily accessible and cleanable for the hydronic economizing coil.
    c. An electronic two-position, 3-way valve shall meter water flow to the economizing coil during the economizing mode shall be provided. The

valves shall be factory set to energize the economizing mode at 55°F, while simultaneously halting mechanical operation of the compressor.

d. Hanging brackets with rubber isolation shall be provided for the horizontal version of the economizing coil option. The bracket design shall be the same throughout the equipment.

8. Sound attenuation shall be applied as a standard feature in the product design.

a. A sound reduction package shall include vibration isolation to the compressor and water-to-refrigerant coil, unit base stiffeners, insulated metal compressor enclosure, and a second stage of vibration isolation to the compressor and water-to-refrigerant base pan.

a. Acoustical data obtained in accordance with AHRI 260. Sound power data must be provided at jobsite operating conditions, including blower motor speed.

D. COMPRESSOR

1. The unit shall have a Single Stage high efficiency rotary or scroll type compressor. The compressor shall be dually isolated. External vibration isolation is provided by rubber mounting devices located underneath the mounting base of the compressor. A second isolation of the refrigerant assembly shall be provided under the compressor mounting base. Internal thermal overload protection shall be provided. Protection against excessive discharge pressure is provided by means of a high pressure switch. Protection against a loss of charge is provided by a low pressure safety.

E. SUPPLY AIR FAN AND MOTOR ASSEMBLY

1. Fan shall be a forward-curved centrifugal wheel style constructed of corrosion resistant galvanized material. The fan is placed in a draw-thru configuration and is arranged for top, back or side supply air. This assembly shall attach the wheel and motor to the fan housing providing single side service access.

2. All fan motors for horizontal units .5 – 5 tons shall be multi speed high efficiency PSC, wired on the high speed tap. The motor shall have permanently lubricated and sealed bearings. All motors shall have internal thermal overload protection. [Option: High static pressure motors] All fan motors for vertical units 0.5-5 tons shall be ECM variable speed motors with thermal overload protection. The motor shall be programmed to provide soft starting and a constant torque over a range of static pressures and airflows.

3. Removal of the motor and fan wheel shall be made with the assistance of a factory provided orifice ring assembly. This assembly shall attach the wheel and motor to the fan housing providing single side service access.

4. The fan assembly on horizontal units shall be arranged for back, left, or right discharge. The discharge must also be capable of being changed in the field.

5. All units 6 to 25 ton shall incorporate a belt driven motor selection. Adjustable motor sheave and blower drive assemblies shall allow a greater variation in external static pressures. The motors shall be capable of providing external static pressure as scheduled.

a. Access to the blower motor is provided through the back of the unit by way of two panels, and/or through a side access panel if adjustment to the motor belt or drive assembly are needed.

F. REFRIGERATION CIRCUIT

1. All units shall have a sealed refrigerant circuit that is charged with R-454B refrigerant. The unit will have a bi-directional thermostatic expansion valve that allows equipment operation between 25 and at least 110 F entering fluid temperature. This system shall be clean and free from contaminants and conditions such as drilling fragments, dirt and oil.
2. The water-to-refrigerant heat exchanger shall be of a high quality co-axial coil for maximum heat transfer. Brazed plate heat exchanger type shall not be acceptable. The copper coil shall be deeply fluted to enhance heat transfer and minimize fouling and scaling. The coil shall have a working pressure of 650 psig on the refrigerant side and 400 psig on the water side.
    a. Insulated water to refrigerant heat exchanger and suction line] The water-to-refrigerant heat exchanger, water lines, and refrigerant suction lines shall be insulated to prevent condensation at low temperatures below 60F degrees.
    b. The air-to-refrigerant coil shall contain copper tubes mechanically expanded into evenly spaced aluminum fins. All coils are to be leak tested. The proof must be performed at 650 psig operating pressure and the leak test at 450 psig operating pressure with helium. In addition, the tubes are to be completely evacuated of air prior to shipment. The refrigerant coil distributor assembly shall be of orifice style with round copper distributor tubes. The tubes shall be sized consistently with the capacity of the coil. Suction headers shall be fabricated from rounded copper pipe.
        a. Dehumidification shall be provided through a hot gas reheat option. Hot gas reheat is enabled when the space humidity level is above a user-selectable setpoint. When hot gas reheat is enabled, the fan speed is reduced to enhance the dehumidification effect. The coil consists of 3/8” copper tubes mechanically expanded into evenly spaced aluminum fins. All coils are leak tested to 450PSIG and pressure tested to 650 PSIG at the factory.
3. Access ports shall be factory supplied within the refrigerant circuit on the high and low pressure sides for easy refrigerant pressure or temperature testing. A filter drier shall be provided and factory installed within the refrigerant circuit. Protection against excessive discharge pressure and loss of charge shall be provided.
4. Units shall come standard with a reversing valve for heating and cooling operation. The reversing valve is a pilot operating sliding piston type with replaceable encapsulated magnetic coil. This valve shall be energized in cooling. Refrigerant Metering shall be accomplished with a Bi-directional thermal expansion valve (TXV) as standard. Capillary tubes are not acceptable.

5. All water lines that are located in the indoor air stream shall be insulated with 3/8 inch thick elastomeric insulation. The refrigerant lines that are located in the indoor air stream that are not directly over the drain pan area shall be insulated with 3/8 inch thick elastomeric insulation.

G. ELECTRICAL
1. The factory tested and installed control panel shall contain all necessary devices to allow heating and cooling operation of the equipment to occur from a remote wall thermostat or zone sensor. These devices shall be as follows:

a. 24 Vac blower motor relay

b. 24 Vac compressor contactor for compressor control
c. Field thermostat connections shall be provided for ease of hook-up to terminal locations located in the unit's control box.
d. Lockout function controls excessive cycling of the compressor shall be provided to protect the compressor during adverse operating conditions. The device may be reset by interrupting
power to the 24 Vac control circuit. Reset may be done either at a remote thermostat or through a momentary main power interruption for units with thermostat controls. For units with DDC controls, the reset can be reset at the zone sensor (with an off switch) or a service
tool.
e. A high pressure switch shall protect the compressor against operation at refrigerant system
pressures exceeding 650 psig.
f. Factory installed wire harness shall be available for the Deluxe, ZN524 and UC400(B) control packages.
g. An On/Off Switch shall be mounted on the left hand front corner of the unit and shall be sized per requirements of UL1995 to handle the unit load. The field power connections shall be made at the ON/OFF switch when this option is ordered. The switch shall be mounted on a NEMA compliant junction box. The junction box shall be UL 514 compliant. The junction box shall have knock outs on all four sides to provide access for field wiring to the switch. The switch shall be UL508 compliant and the body shall be constructed of glass reinforced thermoplastic.

2. A single point power connection shall be provided which will power the entire unit including the controls, compressor, blower motor and all installed options.

A. CONTROLS

Unit control box shall contain necessary devices to allow heating and cooling operation to occur from a remote mounted zone sensor. Devices shall be as follows:

1. UC400(B) A microprocessor based terminal unit controller that provides accurate, pressure independent control through the use of a proportional integral control algorithm and direct digital control (DDC) technology. The controller shall be factory-wired, factory tested, and factory-commissioned. Each WSHP unit shall have control logic for standalone control or BAS integration via the BACnet™ MS/TP protocol. Control of the compressor and supply air fan motor is shall be provided by the unit controller to optimize energy efficiency and comfort.
   a. The controller shall have the ability to control to four set points:
      (i) Occupied
      (ii) Occupied standby
      (iii) Occupied bypass
      (iv) Unoccupied

   b. Controller shall also provide anti-short cycle compressor protection, random start delay, filter maintenance timer, timed override, isolation valve control (two position), condensate overflow protection, high and low

pressure protection, low water temperature sensor, diagnostics, test mode for troubleshooting, and dehumidification mode (if specified or scheduled).

c. At a minimum a 75 VA transformer will be provided with a fuse for component safety.

d. Brownout protection will protect the unit from a low voltage condition. Once low voltage has occurred, the anti-short cycle timer will become energized. The voltage will continue to be monitored until it increases. The compressors will be enabled at this time if all start-up time delays have expired, and all safeties have been satisfied.

e. 24 VAC Energy Limiting Class II, at a minimum a 50 VA transformer will be provided with a fuse for component safety.

f. Anti-short cycle compressor protection shall prevent rapid cycling of the compressor during changeover from heating to cooling or vice-a-versus.

g. Brownout protection will protect the unit from a low voltage condition. Once low voltage has occurred, the anti-short cycle timer will become energized. The voltage will continue to be monitored until it increases. The compressors will be enabled at this time if all start-up time delays have expired, and all safeties have been satisfied.

2. Zone sensor:
   a. Provide zone sensor with temperature set point control, fan control and occupancy override.
   b. Controls shall operate unit as directed by local occupant to the desired stage of cooling or heating.
   c. Refer to sequence of operation for additional details.

PART 3 EXECUTION

1.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Locate units as indicated, level and shim units, and anchor to structure.
C. Protect units with protective covers during balance of construction.

C. WATER SOURCE HEAT PUMPS (Less than 6 Tons)

PART 4 GENERAL

4.01 RELATED SECTIONS

A. Section 250200 – Controls – Direct Digital.
B. Section 231200 – Sheet Metal and Flexible Duct
C.

4.02 REFERENCES

A. ANSI/AHRI/ASHRAE/ISO13256-1 Performance for Water-Source Heat Pump Equipment.
B. CSA C22.2 No. 186.1 Central Forced Air Unitary Heat Pumps with or without Electric Resistance Heat.

4.03 SUBMITTALS

A. Product Data: For each type of product
   1. Include rated capacities, furnished specialties, and accessories for each model.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Include diagrams for power, signal, and control wiring.

C. Manufacturer shall provide a paragraph by paragraph specification review with the product submission detailing compliance with or deviation from the specifications. Submittals without specification review will be returned un-reviewed.

D. Submit operation and maintenance data including manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data to include parts list and wiring diagrams.

4.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products per manufacturer's recommendations.

B. Comply with manufacturers installation instructions for rigging, unloading and transporting units.

C. Unit shall be protected from physical damage and in compliance with LTL Rule 180.

4.05 WARRANTY

A. Provide Whole Units Parts and Labor Warranty for the duration of one year from start-up Units shall come with a 5-year compressor parts only warranty. Warrant that all products are free from defects in material and workmanship and have the capacities and ratings set forth in manufacturer's catalogs and bulletins.

4.06 MAINTENANCE AGREEMENT

A. Furnish complete service and maintenance of units for one year from Date of Substantial Completion.

B. Provide maintenance service as outlined in manufacturer's operating and maintenance data. Provide 24 hour emergency service on breakdowns and malfunctions.

C. Submit copy of service call work order or report and include description of work performed.

4.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with documented experience.

PART 5 PRODUCTS

5.01 SUMMARY

A. HIGH EFFICIENCY WATER-SOURCE HEAT PUMPS, 6 TONS AND SMALLER

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trane
2. Daikin
3. Climate Master
4. Water Furnace

C. Description: Packaged water-source heat pump with temperature controls; factory assembled, tested, and rated according to ASHRAE/AHRI/ISO-13256-1.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
2. Products shall be designed, rated, and certified in accordance with ISO-AHRI 13256-1. Units shall meet the efficiency standards of the ASHRAE 90.1 – 2016.
3. Products shall be designed, rated and certified in accordance with ETL, CETL and ISO-AHRI 13256-1. Units shall meet the efficiency standards of the ASHRAE 90.1 2016 standard.

D. GENERAL UNIT DESCRIPTION

1. The unit frame shall be constructed of zinc coated, heavy-gauge, galvanized steel. The panels are acoustically insulated with ½ inch matte faced glass fiber insulation [option: foil faced insulation with no exposed edges to prevent glass fiber in the airstream]. The insulation shall be UL listed and meets NFPA-90A and UL 181 standards.
2. The manufacturer's maintenance instructions shall describe the proper cleaning procedure for the unit. Access for inspection and cleaning of the unit drain pan, coils and fan section shall be provided. The unit shall be installed for proper access. Procedures for proper access, inspection and cleaning of the unit shall be included in the maintenance manual.
3. All units shall be factory test operated prior to shipping ..
4. Horizontal unit airside panels shall be interchangeable for ease of field convertibility of the return and supply air.
5. Vertical units shall have either Top or Back supply-air with Left or Right return-air.
6. Units shall be provided with 2" Throwaway Filter MERV13.
    a. A ducted filter rack shall be factory mounted for the use 2 inch 2x2, MERV 13 filters and shall provide easy access to the filters from the side of the filter rack through a door that does not require a tool. Duct collars will be built into the filter rack to provide an easy means to connect the duct work to the unit.
7. Drain Pan
    c. A stainless steel unit drain pan shall be provided. The stainless steel material shall meet the requirements of ASTM A480/A480M and comply with the chemical composition requirements of ASTM A240 - 304. The drain pan shall be insulated to prevent moisture accumulation on the drain pan material. The drain pan insulation material shall be suitable to be used in the airflow and consists of closed cell elastomeric insulation, complying with flammability requirements of UL94-5V
    d. The unit as standard will ship with a solid state electronic switch or manufacturer’s standard condensate overflow switch complying with UL 508.
8. Sound attenuation shall be applied as a standard feature in the product design.
    a. Acoustical data obtained in accordance with AHRI 260. Sound power data must be provided at jobsite operating conditions, including blower motor speed.

E. COMPRESSOR

1. The unit shall have a have Two-Stage high efficiency scroll type compressor. The compressor shall be dually isolated. External vibration isolation is provided by rubber mounting devices located underneath the mounting base of the compressor. A second isolation of the refrigerant assembly shall be provided under the compressor mounting base. Internal thermal overload protection shall be provided. Protection against excessive discharge pressure is provided by means of a high pressure switch. Protection against a loss of charge is provided by a low pressure safety.

F. SUPPLY AIR FAN AND MOTOR ASSEMBLY

1. Fan shall be a forward-curved centrifugal wheel style constructed of corrosion resistant galvanized material. The fan is placed in a draw-thru configuration and

is arranged for top, back or side supply air. This assembly shall attach the wheel and motor to the fan housing providing single side service access.

2. Motor shall be a permanently lubricated, programmable EC motor. The ECM motor shall be programmed to provide soft starting and a [constant CFM on horizontal units][constant torque on vertical units] over a range of static pressure. A means to adjust the air flow shall be provided on the control board. The motor shall contain a quick disconnect plug.
3. The fan assembly on horizontal units shall be arranged for back, left, or right discharge. The discharge must also be capable of being changed in the field.
4. Removal of the motor and fan wheel shall be made with the assistance of a factory provided orifice ring assembly. This assembly shall attach the wheel and motor to the fan housing providing single side service access.

G. REFRIGERANT CIRCUIT

1. All units shall have a sealed refrigerant circuit that is charged with R-454B refrigerant. The unit will have a bi-directional thermostatic expansion valve that allows equipment operation between 25 and 120 degrees F entering fluid temperature. .
2. The water-to-refrigerant heat exchanger shall be of a high quality co-axial coil for maximum heat transfer. Brazed plate heat exchanger type shall not be acceptable. The copper coil shall be deeply fluted to enhance heat transfer and minimize fouling and scaling. The coil shall have a working pressure of 650 psig on the refrigerant side and 400 psig on the water side.
    a. The water-to-refrigerant heat exchanger, water lines, and refrigerant suction lines shall be insulated to prevent condensation at low temperatures below 60F degrees.
3. The air-to-refrigerant coil shall contain copper tubes mechanically expanded into evenly spaced aluminum fins. All coils are to be leak tested. The proof must be performed at 650 psig operating pressure and the leak test at 450 psig operating pressure with helium. In addition, the tubes are to be completely evacuated of air prior to shipment. The refrigerant coil distributor assembly shall be of orifice style with round copper distributor tubes. The tubes shall be sized consistently with the capacity of the coil. Suction headers shall be fabricated from rounded copper pipe.
4. Dehumidification shall be provided through a hot gas reheat option where scheduled. Hot gas reheat is enabled when the space humidity level is above a user-selectable setpoint. When hot gas reheat is enabled, the fan speed is reduced to enhance the dehumidification effect. The coil consists of 3/8” copper tubes mechanically expanded into evenly spaced aluminum fins. All coils are leak tested to 450PSIG and pressure tested to 650 PSIG at the factory.
5. Access ports shall be factory supplied within the refrigerant circuit on the high and low pressure sides for easy refrigerant pressure or temperature testing. A filter drier shall be provided and factory installed within the refrigerant circuit. Protection against excessive discharge pressure and loss of charge shall be provided.
6. Units shall come standard with a reversing valve for heating and cooling operation. The reversing valve is a pilot operating sliding piston type with replaceable encapsulated magnetic coil. This valve shall be energized in cooling. Refrigerant Metering shall be accomplished with a Bi-directional thermal expansion valve (TXV) as standard. Capillary tubes are not acceptable.

7. All water lines that are located in the indoor air stream shall be insulated with 3/8 inch thick elastomeric insulation. The refrigerant lines that are located in the indoor air stream that are not directly over the drain pan area shall be insulated with 3/8 inch thick elastomeric insulation.

H. ELECTRICAL

1. The factory tested and installed control panel shall contain all necessary devices to allow heating and cooling operation of the equipment to occur from a remote wall thermostat or zone sensor. These devices shall be as follows:

h. 24 Vac energy limiting class II [50 VA (minimum) transformer applicable to 0.5 to 5 ton units.
i. 24 Vac blower motor relay
j. 24 Vac compressor contactor for compressor control
k. Field thermostat connections shall be provided for ease of hook-up to terminal locations located in the unit's control box.
l. Lockout function controls excessive cycling of the compressor shall be provided to protect the compressor during adverse operating conditions. The device may be reset by interrupting
power to the 24 Vac control circuit. Reset may be done either at a remote thermostat or through a momentary main power interruption for units with thermostat controls. For units with DDC controls, the reset can be reset at the zone sensor (with an off switch) or a service
tool.
m. A high pressure switch shall protect the compressor against operation at refrigerant system
pressures exceeding 650 psig.
n. Factory installed wire harness shall be available for the Deluxe, ZN524 and UC400(B) control packages.
h. A Disconnect Switch shall be unit-mounted and easily accessed from the front of the unit. The disconnect switch can be locked in the off position with one padlock. The disconnect switch is UL508 listed. A single point power connection shall be provided which will power the entire unit including the controls, compressor, blower motor and all installed options.

I. CONTROLS

Unit control box shall contain necessary devices to allow heating and cooling operation to occur from a remote mounted zone sensor. Devices shall be as follows:

1. A microprocessor based terminal unit controller that provides accurate, pressure independent control through the use of a proportional integral control algorithm and direct digital control (DDC) technology. The controller shall be factory-wired, factory tested, and factory-commissioned. Each WSHP unit shall have control logic for standalone control or BAS integration via the BACnet™ MS/TP protocol. Control of the compressor and supply air fan motor is shall be provided by the unit controller to optimize energy efficiency and comfort.
   a. The controller shall have the ability to control to four set points:
      (i) Occupied
      (ii) Occupied standby
      (iii) Occupied bypass
      (iv) Unoccupied

b. Controller shall also provide anti-short cycle compressor protection, random start delay, filter maintenance timer, timed override, isolation valve control (two position), condensate overflow protection, high and low pressure protection, low water temperature sensor, diagnostics, test mode for troubleshooting, and dehumidification mode (if specified or scheduled).
c. At a minimum a 75 VA transformer will be provided with a fuse for component safety.
d. Brownout protection will protect the unit from a low voltage condition. Once low voltage has occurred, the anti-short cycle timer will become energized. The voltage will continue to be monitored until it increases. The compressors will be enabled at this time if all start-up time delays have expired, and all safeties have been satisfied.
e. Provide a wireless communications interface that enables wireless communications between system controls, unit controls, and wireless sensors that control products that use the BACnet® protocol. The Interface shall replace the need for communications wire in all system applications.
f. Provide a wireless sensor compatible with the controller. The sensor shall the same functions as available on wired sensors. No further software or hardware shall be required for site evaluation, installation, or maintenance.

2. Zone sensor:
   a. Provide zone sensor with temperature set point control, fan control and occupancy override.
   b. Controls shall operate unit as directed by local occupant to the desired stage of cooling or heating.
   c. Refer to sequence of operation for additional details.

PART 6 EXECUTION

6.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Locate units as indicated, level and shim units, and anchor to structure.
C. Protect units with protective covers during balance of construction.

B. HOSE KITS

(1) HOSE KIT SIZES SHALL BE AS SCHEDULED ON THE DRAWINGS.

a. Provide a factory-assembled, one piece hose kit/piping package for supply and return connections for each heat pump.

b. Contractor shall provide and install Hays Hose Kit Piping Packages or Nexus Hose Kit Piping packages. Each kit shall be sized for 2.0 to 7.0 feet per second. Valves may be mounted in any altitude and do not require straight sections of pipe either upstream or down stream for proper operation. Griswold is not an acceptable manufacturer.

c. Each return side hose kit/piping package shall include the following:

1) Single piece Y - valve body for sizes ½" – 1-1/2", shall be constructed of hot forged brass with threaded inlets and outlets. 2" – 3" shall be constructed of bronze. 4" and larger shall be constructed of carbon steel with flanged inlets and outlets. All valve bodies are suitable for a minimum of 400 PSIG working pressure.

2) Single pressure/temperature test ports for verifying the pressure differential and system temperature, full flow design ball valve with blow out proof stems for shut off.

3) Manufacturer shall provide certified independent laboratory tests verifying accuracy of performance.

4) All valves shall be labeled with controlled flow direction, flow rate, PSID control range, manufacturer and model number, unit tagging.

5) Check valve.

d. Each supply side hose kit/piping package shall include the following:

1) Single piece Y - valve body for sizes ½" – 1-1/2", shall be constructed of hot forged brass with threaded inlets and outlets. 2-3" shall be constructed of bronze. 4" and larger shall be constructed of carbon steel with flanged inlets and outlets. All valve bodies are suitable for a minimum of 400 PSIG working pressure.

2) Single pressure/temperature test ports for verifying the pressure differential and system temperature, full flow design ball valve with blow out stems for shut off.

3) Strainer shall be Y-type configuration furnished with hose connector blow down valve. Strainer screen shall be stainless steel mesh and easily accessible for cleaning without disconnecting hoses.

4) All valves shall be labeled with flow direction, manufacturer and model number, unit tagging.

e. Stainless Steel Braided Supply and Return Hoses: All hoses shall be equipped with end connections at terminal unit. All end connections shall be either permanently crimped swivel ends or butt welded to carbon steel end fittings to meet stated pressure ratings. Operational temperature shall be rated from fluid freezing to 200 degrees F. Minimum burst pressure shall be four times the working pressure. Furnish with field flushing connection fitting. ½" to 1-1/4" shall be reinforced, fire retardant EPDM rubber, bonded to the inside wall of braiding. 1 ½" and larger shall be a corrugated type 321 stainless steel tube.

f. Flushing Bypass: Provide with means at each heat pump to flush system completely while allowing no fluid flow through heat pump. Also see “Start-up and Flushing” instructions in this section.

g. Condensate Hose Kits: Contractors Option: Manufactured ¾” tubing x 54” long clear flexible plastic hose, with molded P-trap, fittings, couplings and clamps. All condensate drains larger than ¾” shall be field fabricated by contractor to allow for flexible movement. All sizes shall match sizes indicated on drawings.

h. Warrantee: Manufacturer shall warrant all components, for no less than five (5) years from date of purchase. Manufacturer shall warrant steel braided hose for no less than three (3) years from date of substantial completion.

C. KITCHEN EXHAUST FANS

PART 1 - GENERAL

1.1 **SUMMARY**

A. Fan shall be a spun aluminum, G90 Galvanized, roof or wall-mounted, direct drive, upblast centrifugal exhaust ventilator.

1.2 **SUBMITTALS**

A. The manufacturer assumes no liability for the use or results of use of this document. This specification is to be reviewed by the engineer to confirm requirements of the project and building codes are met.

B. As the manufacturer continues product development, it reserves the right to change design and specifications without notice.

1.3 **QUALITY ASSURANCE**

A. ETL Listed and complies with UL705 (electrical) Standards and CSA Std C22.2, No 113.

B. Fan shall bear the AMCA certified rating seal for air performance.

C. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans.

1.4 **WARRANTY**

A. All units are provided with the following 2-year standard warranty from date of shipment.

B. This warranty shall not apply if:

1. The equipment is not installed by a qualified installer per the manufacturer's installation instructions shipped with the product.
2. The equipment is not installed in accordance with Federal, State, and Local codes and regulations.
3. The equipment is misused, neglected, or not maintained per the manufacturer's maintenance instructions.
4. The equipment is not operated within its published capacity.
5. The invoice is not paid within the terms of the sales agreement.

C. The manufacturer shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 2-year warranty period, upon examination by the manufacturer, such part will be repaired or replaced by the manufacturer at no charge. The buyer shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without manufacturer's prior

authorization. All returned equipment shall be shipped by the buyer, freight prepaid to a destination determined by the manufacturer.

PART 2 - PRODUCTS

2.1 **GENERAL ASSEMBLY**

A. The fan shall be factory assembled, tested, and shipped as a complete unit.
B. The following specifications, delivering all capacities scheduled and conforming to the design indicated herein. Alternate layouts or dimensional changes will not be accepted.

2.2 **CONSTRUCTION**

A. The fan wind band shall be constructed of heavy gauge aluminum or G90 Galvanized and shall be spun on an automatic lathe to provide consistent dimensions.
B. Horizontal and vertical internal supports shall be used to fasten the wind band to the discharge apron securely. This provides rigidity for hinging and added strength to reduce shipping damage.
C. The discharge apron shall have a rolled bead for added strength.
D. Base corners shall be welded to provide strength and support for hinging and cleaning and prevent leakage into the building.
E. The fan shall bear a permanently attached nameplate displaying model and serial number of unit for future identification.
F. Nylon washers provide a tight seal. All fasteners in the fan housing shall be backed with nylon washers.
G. The unit shall be factory tested after assembly.

2.3 **CURB**

A. The curb shall be constructed of galvanized steel.
B. The heavy duty G90 galvanized curb cap shall have fully welded corners for added strength and leak protection.
C. Fan #1 has curb options:
1. Hinged Base: Locking Attached
2. Vented
D. Fan #3 has curb options:
1. Hinged Base: Attached
2. Vented

2.4 **WHEEL**

A. The fan wheel shall be centrifugal backward inclined and non-overloading.
B. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise.
C. The wheel blades shall be welded to the wheel inlet cone.
D. If balancing weights are required, they shall be riveted to the blades or wheel.
E. The wheel inlet shall overlap the fan base inlet for maximum performance and efficiency.
F. The wheel shall be firmly attached to the motor shaft with two set screws.

2.5 **MOTOR**

A. Fan(s) Fan #3: Motor Type: Totally Enclosed Air Over Electronically Commutated Motor (TEAO-ECM).
B. Fan(s) Fan #1: Totally Enclosed Fan Cooled (TEFC) motor driven by a Variable Frequency Drive.
C. Motor shall be permanently lubricated and rated for continuous duty.
D. Furnished at the specified voltage, phase, and enclosure. Motor speed shall be variable, controlled using an integrated speed controller.

E. Motors shall be mounted out of the airstream and furnished at the specified voltage, phase, and enclosure.
F. Motor mounting plate shall be constructed of heavy gauge galvanized steel.
G. The motor compartment shall be cooled by outside air drawn through an extruded aluminum conduit tube.
H. An integral electrical conduit running from the fan base to the motor compartment is provided for ease of installation.
I. The conduit tube passage shall be sealed to prevent noise. Silicone rubber grommets shall isolate the conduit tube from the fan housing.
J. The motor compartment shall be a two-piece construction. The cap has quick-release clips to provide fast and easy access to the motor compartment.

2.6 **GREASE**

A. The grease spout shall be made of aluminum tubing, welded to the fan housing. The weld shall be factory tested to ensure no leaks.
B. Grease Box.

2.7 **ECM EXHAUST WIRING PACKAGES**

A. Fan #3: ECM Wiring Package - Manual or 0-10VDC Reference Speed Control (TELCO Motor), CCW Rotation

2.8 **OPTIONS AND ACCESSORIES**

A. Fan #1 has fan options:
1. Grease Box.
2. Fan Base Ceramic Seal - DU/DR240HFA - Installed at Plant - For Grease Ducts.
3. Load Reactor Mounted in Fan.

B. Fan #3 has fan options:
1. Fan Base Ceramic Seal - DU/DR50HFA - Installed at Plant - For Grease Ducts.
2. Bird Screen.
3. Gravity Backdraft Damper (Exhaust).
4. ECM Wiring Package - Manual or 0-10VDC Reference Speed Control -RTC- (TELCO Motor), CCW Rotation.

PART 3 - EXECUTION

3.1 **EXAMINATION**

A. Examine all areas and conditions under which package(s) are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 **INSTALLATION**

A. Install the package in accordance with manufacturer's instructions, drawings, written specifications, manufacturer's installation manual, and all applicable building codes.

3.3 **CONNECTIONS**

A. Electrical connections conform to applicable requirements in Division 26 Sections.

3.4 **SYSTEM START-UP**

A. System start-up is performed by a factory-trained Service Technician.

D. <u>KITCHEN HOODS</u>

PART 1 - GENERAL

1.1 **SUMMARY**

A. The ND2 series is a Type I, wall canopy hood for use over 450°F cooking surface temperatures. The aerodynamic design includes a mechanical baffle and performance enhancing lip for exceptional capture and containment.
B. The hood shall have the size, shape, and performance specified on drawings.

2

2.1 **SUBMITTALS**

A. The manufacturer assumes no liability for the use or results of use from this document. Specifications are to be reviewed by the engineer to confirm the project's requirements and meet Federal, State, and Local codes and regulations.
B. As the manufacturer continues product development, it reserves the right to change design and specifications without notice.
C. The manufacturer shall supply complete computer generated submittal drawings, including hood section view(s) and hood plan view(s). These drawings must be available to the engineer, architect, and owner for their use in construction, operation, and maintenance.

3

3.1 **QUALITY ASSURANCE**

A. This hood is ETL-listed to standard UL710, ULC710, and ULC-S646 when installed in accordance with these installation instructions and National Fire Protection Association Standard "NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations."
B. Built-in compliance with NSF/ANSI Standard 2.
C. The hood shall be ETL Listed as:
    1. "Exhaust Hood Without Exhaust Damper."
    2. ETL Sanitation Listed and built in accordance with NFPA 96.
    3. The ETL label shall list temperature rating(s) and minimum CFM/ft rating(s).

4

4.1 **WARRANTY**

A. All units shall be provided with the following standard warranty:
    1. This equipment is warranted to be free from defects in materials and workmanship, under normal use and service, for a period of 2-years from date of shipment.
B. The manufacturer shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 2-year warranty period, upon examination by the manufacturer, such part will be repaired or replaced by manufacturer at no charge. The buyer shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without manufacturer's prior authorization, and all returned equipment shall be shipped by the buyer, freight prepaid to a destination determined by the manufacturer.
C. Refer to Manufacturer's Operation, Installation, and Maintenance (OIM) Manual for detailed descriptions of what is/is not covered and contact information for warranty claims.

5

PART 2 - PRODUCTS

2.1 **GENERAL**

A. Construction shall be dependent on the structural application to minimize distortion and other defects. All seams, joints, and penetrations of the hood enclosure to the lower

outermost perimeter, which directs and captures grease-laden vapor and exhaust gases, shall have a liquid-tight continuous external weld in accordance with NFPA 96.

B. Duct sizes, CFM, and static pressure requirements shall be as shown on drawings. Static pressure requirements shall be precise and accurate; air velocity and volume information shall be accurate within 1-ft increments along the length of the ventilator.

6

2.2 **CONSTRUCTION**

A. Construction shall be type 430 stainless steel.
B. Double wall insulated front to eliminate condensation and increase rigidity on wide sizes. The insulation shall have a flexural modulus of 475 EI, meet UL 181 requirements and be in accordance with NFPA 90A and 90B.
C. Hood shall be equipped with a minimum of four connections for hanger rods. Hood lengths greater than 12’ will have added hangers.
D. Exhaust duct collar to be 4” high with flange.
E. The grease drain system shall be an enclosed integral part of the hood back and have slopes with an exposed, removable 1/2 grease cup to facilitate cleaning.
F. An integral baffle to direct grease laden vapors toward the exhaust filter bank.
G. Hood shall be furnished with UL classified filters, supplied in size and quantity as required by ventilator.
H. All seams shall be welded and have stainless steel on exposed surfaces.

7

2.3 **FILTERS**

A. Stainless Steel Captrate Solo filter with hook, ETL Listed. Particulate capture efficiency: 85% efficient at 9 microns, 76% efficient at 5 microns.

8

2.4 **OPTIONS**

A. Fire Suppression System: UL 300 fire suppression system.
B. Hood Mounted Utility Cabinet - Cabinet can store listed fire suppression system, listed components, pre-wired electrical controls.

2.5 **ACCESSORIES**

A. End Panel(s) maximize hood performance and eliminate the effects of cross drafts in the kitchen. Units constructed of stainless steel and sized according to hood width and cooking equipment. Exposed edges hemmed for safety and rigidity. Selected panels:
   1. Vertical End Panel
B. Splash panel(s) selected:
   1. Backsplash
C. Wrapper(s) may be installed from the factory or field installed. Wrapper(s) selected:
   1. Wrapper
D. Miscellaneous option(s) selected:
   1. Structural Front Panel – Front panel made with 18 gauge material.

9

PART 3 - EXECUTION

3.1 **EXAMINATION**

A. Examine areas and conditions under which the system is installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

10

3.2 **INSTALLATION**

A. Install in accordance with manufacturer's instructions, drawings, written specifications, manufacturer's installation manual, and all applicable building codes.

E. VENTILATING FANS General

(1) Ventilating fans shall be of the type, capacity, size, etc. here-in-after scheduled. Catalog numbers are listed as design criteria only. Alternate selections will be accepted provided quality, function, etc. are equivalent. All fans shall be UL listed, complete with all required disconnects and starters and shall be AMCA rated and certified. Model numbers listed are Greenheck, acceptable alternates are Penn, Carnes, Acme, Shipman, Jenn-Aire, Loren-Cook, and Twin City. The Architect shall select the color for all exposed fans.

(2) Selection

Refer to the schedule on the plans.

F. KITCHEN MAKE UP AIR UNIT – MAU-1

PART 1 - GENERAL

1.1 **SUMMARY**

A. This section includes packaged heating and cooling units capable of supplying up to 100 percent outdoor air.

1.2 **SUBMITTALS**

A. The manufacturer assumes no liability for the use or results of use of this document. This specification is to be reviewed by the engineer to confirm requirements of the project and building codes are met.

B. As the manufacturer continues product development, it reserves the right to change design and specifications without notice.

1.3 **WIND LOAD DESIGN**

A. Refer to state or local codes for Seismic, Wind, Flood Load Design for additional requirements.

1.4 **QUALITY ASSURANCE**

A. All models shall be ETL listed and comply to safety standards UL 1995, the Standard for Safety for Heating and Cooling Equipment. The Engineer of Record shall take responsibility for the approval of any modifications or additions to the unit, including aftermarket UV or ionization filtration devices.

B. All models shall be ETL listed and comply to safety standards CSA Std. C22.2, No. 236-11.

C. This unit has been tested in accordance to the following standards:

- ANSI/AHRI Standard 340/360
- ANSI/ASHRAE Standard 37
- AHRI Standard 270/370

1.5 **WARRANTY**

A. All units shall be provided with the following standard warranties:

1. 10-Year (non-prorated) parts warranty covering the entire unit when accompanied by a company provided service plan. 5-Year (non-prorated) parts warranty covering the entire unit otherwise.

B. This warranty shall not apply if:
   1. The equipment is not installed by a qualified installer per the manufacturer's installation instructions shipped with the product.
   2. The equipment is not installed in accordance with Federal, State, and Local codes and regulations.
   3. The equipment is misused, neglected, or not maintained per the manufacturer's maintenance instructions.
   4. The equipment is not operated within its published capacity.
   5. The invoice is not paid within the terms of the sales agreement.

C. The manufacturer shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 10-year period, upon examination by the manufacturer, such part will be repaired or replaced by manufacturer at no charge. The buyer shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without manufacturer's prior authorization and all returned equipment shall be shipped by the buyer, freight prepaid to a destination determined by the manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

A. Supply single zone one piece packaged units that are complete as per the following specification, deliver all capacities scheduled, and conform to design indicated herein. Alternate layouts or dimensional changes will not be accepted.

2.2 CABINET

A. Size 2, 3 or 4 units shall be constructed of minimum 20 gauge G-90 galvanized steel riveted together via structural pop-rivets. All metal shall be CNC bent for precise assembly. All metal shall be CNC bent for precise assembly.
   1. Rigging Provisions: Cabinet sizes 2, 3 & 4 shall have a structural base constructed of minimum 14 gauge G-90 galvanized steel. Include full-sized fork pockets and lifting points on all four sides. Include full-sized fork pockets and lifting points on all four sides.
   2. Roof Construction: The lids shall be fabricated by forming a double-standing, self-locking seam that requires no additional support. Roof shall be pitched to allow for proper drainage.
   3. Exterior Wall Construction: All exterior walls shall consist of a double wall, G-90 galvanized steel construction. Cabinet sizes 2, 3 & 4 shall be insulated with 2in. thick, R13 closed cell foam.
   4. Service Access Doors: All door jambs shall be gasketed around their perimeter, and allow for doors to be mounted via removable, spring actuated, stainless steel hinges with stainless steel rivets, and self-compressing latches. Each compartment shall have removable access panels to allow for ease of service and maintainability. Electrical cabinet access doors shall have a door hold installed to prop doors open. All doors shall have stainless steel latches which are pad lockable. Electrical cabinet doors shall be outfitted with schematic/manual pouches

formed into the door, along with wiring diagram attached to the indoor of the door from the factory.

B. Entire interior and exterior casing shall be constructed of minimum G90 galvanized steel. The unit casing will not be painted. Unit shall have undergone a salt spray corrosion test as per ASTM B 117.

2.3 **AIRFLOW CONFIGURATIONS**

A. Discharge: Unit shall be configurable for Down (Vertical) Discharge through the unit's base.
B. Fan #2: Return: Unit shall be configurable for Down (Vertical) Return through the unit's base.
C. Unit intake airflow configuration shall be through use of a fresh/outdoor and return air damper.
    1. Damper: Shall exceed AMCA Class 1A standard for low leakage. Damper assembly shall be a single assembly, and outfitted with an integral bird screen. Louver/gutter system used to divert any drainage through the unit's base – intake air hood not required.
    2. Actuator: A single direct drive damper actuator shall be used with spring return to ensure that the outdoor air section closes when not powered.

2.4 **SUPPLY AIR BLOWER AND MOTOR**

A. All supply fans shall be direct drive (belt-drive not acceptable) variable speed plenum fans.
B. Blower Motor: Motor shall be a premium efficiency motor available as:
    1. Fan #2: Open Drip Proof (ODP) motor driven by a Variable Frequency Drive.
C. Fans to be selected at or near efficiency peak. (Submit fan curves)
D. Blower and motor assembly shall be dynamically balanced. The entire blower and motor assembly shall be mounted on rubber vibration isolators. Wheels balanced as per AMCA 204-96, Balance Quality and Vibration Levels for fans.
E. Unit equipped with total CFM monitoring to measure airflow across supply discharge.

2.5 **REFRIGERATION SYSTEM** Fan #2:

A. Unit shall utilize a variable speed inverter duty scroll compressor with the following features:
    - Fan #2: 25%-100% on 15, 20, 22, 25, and 30 Ton units
    1. Refrigerant: Unit shall be factory charged with R410A refrigerant.
    2. Vibration Isolation: Compressor as well as blower assembly shall each be mounted on rubber vibration isolators to reduce transmission of vibration to the building structure.
    3. Internal Overload Protection: Compressor shall include internal thermal overload production to protect against excessive motor temperatures.
    4. Crankcase Heater: Compressor shall include a crankcase heater to protect against liquid flood-back and elimination of oil foaming on startup. The crankcase heater must remain powered when the compressor is not in operation.
    5. Oil Management: Unit shall utilize both passive and active oil return management using Oil Level Sensor and scheduled oil boosts.
    6. Monitored Envelope: Unit shall monitor all critical refrigeration points to ensure compressor does not operate outside of safe operating envelope.
    7. Throttling Logic: Unit shall allow for high head pressure monitoring throttle mode for high ambient operation, and low suction pressure throttle mode for low capacity operation or any conditions resulting in low suction pressure.

8. Pump-Down: Active pump-down mode with discharge line check valve to protect against liquid migration into compressor during idle times.
9. Defrost mode in optional Heat Pump: When outdoor coils are deemed at risk of freezing, the unit shall simultaneously turn on auxiliary heat while running the heat pump in “cooling” mode to help defrost outdoor coils as needed while still maintain desired leaving air temperatures.

B. The unit shall be outfitted with the following:
1. Indoor Coil: Indoor coil shall be a high efficiency 7 row coil design with aluminum fins mechanically bonded to copper tubes. Coil is staggered to increase turbulence, reduce the coil bypass factor, and ultimately increase the time the air stays within the coil. Includes two probe sensors to read average coil face temperature.
2. Electronic Expansion Valve: Each refrigeration circuit will be outfitted with an electronic expansion valve metering device which can be throttled from 0-100% open to allow for precise superheat control.
3. Indoor Coil Drain Pan: The indoor coil shall be outfitted with a sloped stainless steel drain pan. This pan shall be insulated along the entire base to prevent condensation, and outfitted with a safety overflow switch which will automatically shut down cooling operation prior to water overflowing the drain pan in the event of a drain clog. The entire drain pan shall be 20 GA Stainless Steel construction and wrap beneath the entire coil with flashing on entering side of coil to ensure capture of all condensate. Drain pan discharge pipe shall also be stainless steel construction. Drain pan shall be pitched to exceed ASHRAE 62.1 standard.
4. Base of the condensing coil cabinet shall be pitched away from the unit as a safety to ensure all draining exits away from the curb.
5. Optional Hot Gas Reheat Coil: The unit shall include an optional copper tube and aluminum fin hot gas reheat coil mounted downstream of the indoor coil. This coil shall be controlled via fully modulating hot gas reheat valve to provide precise reheat temperature control. This coil shall include the addition of an evaporative coil leaving condition sensor to maintain a coil dew point. This also prevents operation of a dehumidification call when intake dew point conditions are found to be below space dew point conditions, preventing wasted energy.
6. Outdoor (Condenser) Coil: Outdoor coil shall be a high efficiency coil design with aluminum fins mechanically bonded to copper tubes. The coil shall be downward sloped to protect coil from hail damage. Optional hail guards may also be outfitted to the outdoor coil for added protection from hail bouncing off of the roof of the unit up the coil.
7. Outdoor Fans: The outdoor coil shall have a vertical discharge outfitted with quiet, efficient, fully modulating Electronically Commutated Motor (ECM) condensing fans. These fans shall modulate to maintain a temperature differential between outside air and the outdoor coil.

C. To help mitigate any long-term potential for leaks or hardware failures, the unit shall be outfitted with the following protection measures:
1. Suction line accumulator for added protection against liquid entering suction line of compressor.
2. Bi-flow, low pressure drop, filter drier.

3. Electronic Expansion Valve (EEV) for precise superheat control. EEV shall open partially allowing system pressure equalization prior to activation of the compressor.
4. On optional heat pump units, use of a single 3-way reheat valve to prevent obstructions due to valve failure.
5. Protective rubber sleeves installed on all distribution lines of indoor coil to prevent wear from rubbing.
6. All refrigeration ports shall be short-stub assembly and any access port with a transducer or switch is mounted vertically to mitigate risk of bent/cracked stub joints.
7. Refrigeration circuit shall be mechanically CNC pre-bent tubing wherever possible with minimal brazed joints to minimize points for potential refrigeration leaks.
8. Factory tested for leaks via high pressure nitrogen decay and helium tracer gas testing.
9. Suction line temperature sensor failure detection.
10. Preventative failure alerts through a manufacturer provided, cloud based, cellular remote monitoring system.

2.6 **FILTERS**

A. Provide filters as part of unit. All filters shall be furnished and installed to meet the performance requirements set forth in the schedule and as specified under another section of this work.
B. All filters shall be installed on tracks for easy removal from the unit.
C. Up to 3 layers of outdoor air filtration installed. Unit shall ship with a 2” washable metal mesh outdoor air filter. Mixed air shall have optional 2” MERV-8 filters. Mixed air shall have optional 2” MERV-13 filters.
D. Unit shall have an optional adjustable pressure differential sensor for the filter bank to alert in the event of a clogged filter.

2.7 **ELECTRICAL**

A. All controls shall be pre-wired and housed in an insulated electrical cabinet within the unit to protect against risk of condensation.
B. Fan #2: Units shall be provided with separate electrical heat connection.
C. Unit shall be provided with a door safety switch that de-energizes the supply fan when the door is opened.
D. Unit shall be provided with a factory mounted averaging supply air temperature sensor to allow for accurate discharge temperature readings within unit when a downstream sensor is not installed. Field mounted and wired discharge air sensors will not be accepted.
E. Unit shall be provided with a factory mounted averaging intake air temperature sensor to allow for accurate intake temperature reading regardless of how the OA/RA dampers are positioned.
F. The electrical cabinet shall be outfitted with the following:
    1. Disconnect for power to fully de-energize the electrical cabinet.
    2. LED electrical cabinet service light with automatic activation upon door switch.
    3. Color wiring schematics, laminated to the interior wall of the cabinet doors.
    4. Factory mounted disconnect with unit bottom knockouts.
    5. A LED backlit, LCD Human-Machine Interface (HMI) shall be mounted within the unit’s control cabinet to allow for all set points configuration and refrigeration system monitoring at the unit.

6. Optional 120V, 15A unit powered or unpowered convenience outlet.

G. All sensors shall be wired back to the main control board that continuously monitors all critical components and makes decisions based on pre-determined logic to accurately control the following:
   1. PID logic to control heater modulation ensuring precise discharge/space temperature control.
   2. PID logic to control compressor speed to provide precise control over evaporative coil temperatures, leaving dew point, and discharge/space temperatures.
   3. PID logic for Outdoor fan modulation to maintain an optimal outdoor coil temperature.
   4. PID logic for Electronic Expansion Valve (EEV) position to maintain a precise superheat temperature.
   5. PID logic for Modulating Reheat valve to limit supply air temperature and relative humidity based off of space or discharge conditions.

2.8 **CONTROLS**

A. Unit shall be outfitted with a control board to allow for full control of the entire unit.
B. Provide air flow switch on the supply fan system to sense air flow with available set of contacts for connection to BMS for airflow alerts.
C. All unit controls shall be compatible with BACnet based building management systems.
D. All units shall be outfitted with CASLink cloud based monitoring, which monitors every point of operation. Provides configurable automated fault alert e-mails, and remote control capabilities.
E. Integrated cellular module to provide remote connection to monitoring services to view both real time and historical unit operation. Data shall be stored a minimum of 3 years on the cloud. Data sample rate shall be a maximum of 60 seconds.
F. Temperature Control System
   1. Space Temp Control (Heating)
      Unit modulates the burner flame (current supply in the case of electric heating) to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using heating PID controls designed specifically for the Paragon. Minimum and maximum discharge set points can be set to limit the temperature entering the space. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.
   2. Space Temp Control (Cooling)
      Fan #2: Unit modulates the compressor frequency to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using cooling (heating when in heat pump mode) PID controls designed specifically for the Paragon. Minimum and maximum discharge set points can be set to limit the temperature entering the space. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.
   3. Space Temp Control (Heat Pump)
      Fan #2: Unit modulates the compressor frequency to accurately maintain the desired space temperature set point and compensate for fluctuations in entering

air temperature, air volume and % of OA using heating PID controls designed specifically for the Paragon. Minimum and maximum discharge set points can be set to limit the temperature entering the space. When ambient temperatures drop below a user configurable minimum outdoor air temperature set point, or the unit is not able to maintain a user configurable minimum discharge temp for 5 minutes time, the heat pump will initiate its backup heat source. Initiation of backup heater operation shall ensure discharge temps are maintained prior to disabling heat pump to make sure discharge temps are never impacted during changeover. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.

4. Space Humidity Control (Dehumidification) Fan #2: Unit modulates the compressor frequency to accurately maintain a desired evaporative coil dew point measured via a coil mounted temperature sensor between the evaporative and hot gas reheat coils. A fully modulating hot gas reheat valve shall utilize excess waste heat from the condensing section feeding the hot gas reheat coil with the precise amount of heat needed to accurately reheat the airstream in order to maintain a desired space temperature compensating for fluctuations in entering air temperature, air volume and % of OA using proprietary dehumidification PID controls designed specifically for the Paragon.

G. Activation Controls (For Paragon Units):

1. Activate Based on Intake (Heating) Unit will activate heating when the intake temperature drops below the desired set point.
2. Activate Based on Intake (Cooling) Fan #2: Unit will activate cooling when the intake temperature rises above the desired set point.
3. Activate Based on Intake (Dehumidification) Fan #2: Unit will activate dehumidification when the intake conditions rise above the desired intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
4. Activate Based on Space (Heating) Unit will activate heating when the space temperature drops below the desired set point.
5. Activate Based on Space (Cooling) Fan #2: Unit will activate cooling when the space temperature rises above the desired set point.
6. Activate Based on Space (Dehumidification) Fan #2: Unit will activate dehumidification when the space set point rises above the desired space set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
7. Activate Based on Both (Heating) Unit will activate heating when the space AND intake temperature drop below the desired set point.
8. Activate Based on Both (Cooling) Fan #2: Unit will activate cooling when the space AND intake temperature rise above the desired set point.

9. Activate Based on Both (Dehumidification)
   Fan #2: Unit will activate dehumidification when the space and intake set point rise above the desired space and intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
10. Activate Based on Either (Heating)
    Unit will activate heating when the space OR intake temperature drops below the desired set point.
11. Activate Based on Either (Cooling)
    Fan #2: Unit will activate cooling when the space OR intake temperature rises above the desired set point.
12. Activate Based on Either (Dehumidification)
    Fan #2: Unit will activate dehumidification when the space or intake set point rises above the desired space or intake set point, with activation set points configured to a Dew Point, Relative Humidity or a combination of Dew Point/Relative Humidity.
13. Activate Based on Stat (Heating)
    Unit will activate heating when the space thermostat sends a 24V signal to W and G on the main control board. Unit will modulate to maintain a constant discharge heat set point.
14. Activate Based on Stat (Cooling)
    Fan #2: Unit will activate cooling when the space thermostat sends a 24V signal to Y and G on the main control board. Unit will modulate to maintain a constant discharge cool set point.

2.9 **ROOF CURB**

A. Unit shall be factory assembled, and constructed of 18GA galvanized steel, with optional 16GA available.
B. Curb shall be fully insulated with 1” acoustical and thermal insulation.
C. Curb shall be factory outfitted with duct support hangers.

2.10 **VARIABLE FREQUENCY DRIVES**

A. Provide Variable Frequency Drive for the compressor as part of the AC unit. VFD shall be furnished and installed to meet the performance set forth in the schedule and as specified under another section of this work.
   1. Accessories to be furnished and mounted by the drive manufacturer and contained in a single enclosure. (The use of more than one enclosure is not acceptable).
B. Provide Variable Frequency Drive for speed control on all non-ECM direct drive supply fans.
C. All VFDs shall provide the following inherent protections:
   1. Phase protection.
   2. Brownout protection.
   3. Overload/Overheat protection.
   4. Soft starts to protect bearings/hardware.
   5. Low & High voltage & over-torque protections.

PART 3 - EXECUTION

3.1 **EXAMINATION**

A. Examine areas and conditions under which packaged units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 **INSTALLATION**

A. Install in accordance with manufacturer's instructions, drawings, written specifications, manufacturer's installation manual and all applicable building codes.

3.3 **CONNECTIONS**

A. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts.
B. Electrical: Conform to applicable requirements in Division 26 Sections.

3.4 **SYSTEM START-UP**

A. System start up is performed by a factory trained Service Technician.

G. DEDICATED OUTSIDE AIR UNIT OA-1

PART 7 GENERAL

7.01 SECTION INCLUDES

A. Packaged outdoor air unit.
B. Heat exchanger.
C. Refrigeration components.
D. Unit operating controls.
E. Electrical power connections.
F. Operation and maintenance service.

7.02 REFERENCES

A. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems. (all)
B. ETL Listed and Labeled
C. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration. (all)
D. Standard for Safety Heating and Cooling Equipment-Third Edition, UL 1995/CSA C22.2 236-05, dated February 18, 2005, with revisions through July 30, 2009 (all for cooling and for electric heat)
E. ANSI/ASHRAE/IESNA 90.1-2010 - Energy Standard for New Buildings Except Low-Rise Residential Buildings.
F. ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.
G. ANSI/NFPA 70-1995 - National Electric Code. (all)

7.03 SUBMITTALS

A. Submit unit performance data including: capacity, nominal and operating performance.
B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
C. Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.
E. Shop drawings submitted for approval shall be accompanied by a copy of the purchase agreement between the Contractor and an authorized service representative of the manufacturer for check, test and start up and first year service.

7.04 DELIVERY, STORAGE and HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage. Leave factory shipping covers in place until installation.

7.05 WARRANTY

A. Provide 1 year parts and labor warranty from project completion date.

B. Provide 5 year compressor warranty from project completion date.

7.06 MAINTENANCE SERVICE

A. Furnish complete parts and labor service and maintenance of packaged outdoor air units for 1 year year from Date of Substantial Completion.

B. Provide maintenance service with a two month interval as maximum time period between calls. Provide 24 hour emergency service on breakdowns and malfunctions.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data.

D. Submit copy of service call work order or report and include description of work performed.

E. Must have twenty certified technicians within a four hour radius of the jobsite.

7.07 REGULATORY REQUIREMENTS

A. Unit shall conform to the appropriate standards listed in Section 103.

1. In the event the unit is not approved by a Nationally Recognized Testing Laboratory (NRTL) for compliance with the appropriate standards, the manufacturer shall, at manufacturer’s expense, provide for a field certification and labeling of unit by an NRTL to the appropriate standards. Manufacturer shall, at manufacturer’s cost, complete any and all modifications required by NRTL prior to certification and field labeling. Manufacturer shall include coverage of all modifications in unit warranty.

7.08 EXTRA MATERIALS

A. Provide one set of filters.

2. PRODUCTS

7.09 SUMMARY

A. The contractor shall furnish and install packaged outdoor air unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS

1. Trane: Horizon (Packaged Outdoor Air Unit)
2. Aaon
3. Water Furnace
4. United Cool Aire
5. Daikin

7.10 GENERAL UNIT DESCRIPTION

A. Unit(s) furnished and installed shall be indoor packaged outdoor air unit (s) as scheduled on contract documents and these specifications. Unit(s) shall consist of insulated casing with compressor(s), water-cooled condenser coil, evaporator coil, air filters, supply motors and unit controls.

B. Before shipment, each unit(s) shall be leak tested, dehydrated, charged with refrigerant (R-454B) and compressor oil, and factory run tested for proper control operation.

C. Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

D. Wiring internal to the unit shall be colored and numbered for identification.

7.11 UNIT CASING

A. Cabinet: Zinc-coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B45. Structural members shall be a minimum of 16 gauge with access doors and removable panels of minimum 20 gauge.

B. Panels: 2" double-wall foamed panel construction throughout the indoor section of unit to provide nonporous, cleanable interior surfaces. All interior seams exposed to airflow shall be sealed.

C. Insulation: 2" polyisocyanurate Foam metal encapsulated with no exposed edges. Initial R value of 6.6 per inch of thickness.

D. Cabinet construction shall provide access panels for all parts requiring service.

E. Cabinet top cover shall be one piece construction or where seams exist, it shall be double-hemmed and gasket-sealed.

F. Panels: Water- and air-tight hinged panels with handles shall provide access to filters, heating section; ERV and power exhaust fan section, supply air fan section, evaporator coil section, and unit control section. Door hardware shall be oriented to allow the door swing to be reversed.

1. Latches with hold down hooks will be factory installed on hinged access doors.

G. Unit shall include a motor operated outside air damper and optional return air damper assembly constructed of galvanized steel, and air foil blades with rubber edge seals. Damper blades shall be designed to have no more than 4 cfm of leakage per sq ft of damper area and shall exceed ASHRAE 90.1 requirements. Linkage shall be concealed out of airstream, within the damper frame to reduce pressure and noise. Damper assembly shall be controlled by a spring return two position or fully modulating actuator. Dampers shall not be sized for air velocities exceeding 2000 fpm.

H. Type 430 Stainless steel drain pan sloped in two directions to ensure positive drainage. Pan shall have a minimum depth of 2". Seams exposed to standing water shall be welded liquid tight. Base of pan shall be insulated with 1" thick foam insulation.

I. Provide openings either on side of unit or thru the base for power, control and gas connections.

J. The base of the unit shall have provisions for forklift and crane lifting

7.12 POWER WIRING

A. Field wiring access to be provided thru unit base into isolated enclosure with removable cover.

B. Power wiring to be single point connection.

C. Unit shall be factory wired to field wiring terminal block mounted in isolated enclosure.

D. Factory wired main power disconnect device, overcurrent and SCCA rated for total unit power connection.

E. Factory installed safety barrier shall isolate all high voltage components, mounted inside electrical compartment, to protect service personnel from incidental contact.

F. Factory wired Phase monitor shall be included as standard.

G. Factory to mount and wire optional 120 volt convenience outlet. Field wiring of convenience outlet not acceptable.

7.13 LOW VOLTAGE CONTROLS (Factory Mounted Controller Required)

A. Factory wired 24 volt control system complete with required transformers and fusing.

B. Main Control Module (MCM) shall prevent simultaneous operation of any modes and shall enable operation in Dehumidification, Cooling, Heating or Economizer mode based on programmed settings for
   1. Outdoor air conditions and discharge air temperature
C. MCM shall accept separate setpoints for Occupied and Unoccupied states.
D. MCM shall control based on dew point design settings for Dehumidification and Economizer modes, and sensible temperature settings for heating and cooling modes.
E. MCM shall have onboard clock and scheduling function for occupancy.
F. MCM shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
G. Factory installed and wired sensors shall monitor Outdoor Air (OA) temperature, humidity and evaporator leaving air temperature. If an Energy Recovery Ventilator (ERV) is chosen, factory installed and wired sensors shall monitor the exhaust ERV leaving air temperature for defrost control.
H. Supply air sensor shall be furnished with unit. Installing contractor shall install remote mounted supply air sensor in supply air duct and field wire to the unit.
I. Space temp and humidity sensor shall be furnished and field wired to unit by the installing contractor. Locate in the Corridor below unit location.
J. Fully modulating hot-gas reheat shall be enabled in dehumidification mode and cooling mode with modulation controlled by MCM to maintain (supply air temperature / space temperature).
K. System controls shall include anti-cycle timing and minimum compressor run/off-times.
L. Systems controls shall be digital, programmable type with access via factory installed and wired touchscreen, or through portable computer connection. All setpoints, unit functions, and status shall be accessible via the touchscreen or portable computer.
M. All low voltage field wiring connections shall be made at factory installed low voltage terminal strip.

7.14 FANS AND MOTORS

A. Indoor fan shall be direct drive plenum fan, factory installed and wired to on-board Variable Frequency Drive and shall be equipped with slide out service access.
B. All fan motors shall be premium efficiency ODP and meet the U.S. Energy Policy Act of 2005/10 (EPACT).
C. All fan motors shall either be permanently lubricated and/ or have internal thermal overload protection.
D. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

7.15 EVAPORATOR CONDENSOR AND REHEAT COILS

A. Evaporator and hot gas reheat coils shall be constructed of copper tubes mechanically bonded to a configured aluminum plate fin.
B. Coils shall be leak tested at the factory to ensure pressure integrity. The evaporator coil, reheat coil and condenser coil shall be leak tested to 500 psig and pressure tested to 500 psig.
C. Evaporator coil shall have four interlaced rows for superior sensible and latent cooling with a maximum of 12 fpi.
D. The condenser coils shall be a coaxial "tube in tube" design. Water flows through the inner tube while refrigerant flows in the annulus between the inner and outer tubes.

The coils have a convoluted multi-lead inner tube. The resulting convoluted tube has increased heat transfer surface area per unit length yet still permits full flow of both water and refrigerant around its entire periphery for improved performance. Turbulence imparted by the convolutions to both the water and refrigerant flows further enhances the thermal performance, while inhibiting the accumulation of deposits on the surfaces.

E. Reheat coil shall be fully integrated into the supply air and fan system and capable of delivering design supply air temperature.

F. To prevent re-hydration of condensate from evaporator coil, the evaporator coil face and the hot gas reheat coil face shall be separated a minimum of six inches.

G. Unit shall be equipped with an adjustable 6" filter rack upstream of the evaporator to match the filter requirements specified in the Air Filtration section

H. Fans shall be statically balanced.

7.16 REFRIGERANT CAPACITY CONTROL

A. Capacity control for units equipped with digital scroll compressors, or variable speed compressors, shall be accomplished through a 0-10V signal by the MCM to the compressor controls.

7.17 REFRIGERATION SYSTEM

A. Compressor(s): All units shall have direct-drive, hermetic, scroll type compressors.

B. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage.

C. Internal overloads shall be provided with the scroll compressors.

D. Each compressor shall be mounted on rubber vibration isolators, to reduce the transmission of noise.

E. Provide each unit with two hermetically sealed refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, liquid line charging port, discharge, suction and liquid line pressure ports, sight glass, thermal expansion valve, 4-way reversing valve, suction line accumulator, and charge compensator.

F. Provide each circuit with automatic reset high and low pressure switches for safety control.

7.18 POWER EXHAUST/RETURN SECTION

A. Provide, a factory installed power exhaust assembly that shall be designed to ventilate return air to atmosphere.

B. Fan wheel shall be direct drive plenum fan, factory installed and wired to on-board Variable Frequency Drive Other fan construction is not acceptable

C. Fan mount to be fixed.

D. Exhaust to ventilate through automatic louver located on both sides of unit cabinet.

7.19 OUTDOOR AIR SECTION ENERGY RECOVERY (ERV)

A. The rotor media shall be made of aluminum, formed into a honeycomb structure to minimize pressure loss and avoid plugging. Paper, plastic or fibrous media are not acceptable. The rotor media must be coated to resist corrosion. All surfaces must be coated with a non-migrating desiccant layer to insure that adequate latent capacity is provided. The desiccant coating must be firmly bonded to the aluminum surface and will not be dislodged when challenged with high velocity air up to 5000 feet per minute. Products that loose desiccant when served with high velocity air are not acceptable. The cassette must be a slide out design for serviceability. The media shall be cleanable with low temperature steam, hot water or light detergent without degrading the latent recovery.

B. Sensible and latent recovery efficiencies must be clearly documented through a testing program conducted in accordance with ASHRAE Standard 84 and AHRI 1060. The testing must have been conducted by a qualified independent organization. The performance test reports must be provided for engineering review as part of the submittals for this project.

C. The rotor design shall ensure laminar airflow to minimize parasitic pressure loss and to optimize the operating efficiency of the system fans. The pressure loss across the media shall be no greater than the scheduled pressure loss values. The energy wheel shall operate effectively up to 180 degrees F.

D. The rotor media shall be permanent, with an anticipated life of 20 years. It must be tested in accordance with ASTM Standard E-84 and provide smoke and flame spread ratings of less than 25 and 50 as required by NFPA 90A and UL 1995. A copy of the ASTM E-84 test report confirming the method of test and results shall be provided with the submittal. Heat recovery wheels incorporating “throw-away” media and tested to UL900 for Class 2 filters are not acceptable.

E. The wheel manufacturer must have been producing energy recovery wheels for a minimum of ten years.

F. The rotor shall be supplied with perimeter brush seals and face contact seals to minimize air leakage and wheel bypass.

G. The rotor media shall be supported by a structural aluminum hub and aluminum reinforcing spoke system. The rotor bearings must be greaseable and provide L10 life in excess of 20 years.

H. The cassette framework shall be made of galvanized steel to prevent corrosion.

I. The rotor must be driven by long-life polyurethane/polyester composite link belt system. The rotor/cassette shall be designed so that belt can be removed or serviced without the removal of the bearing. A 3 phase A/C gear motor shall be utilized to accommodate variable speed applications.

J. Where variable speed control is required for frost prevention, it must be accomplished by the use of a factory installed and wired A/C inverter. The variable speed drive system shall allow for a minimum 60:1 turndown ratio.

7.20 BUILDING MANAGEMENT SYSTEM

A. Interface control module to Energy Management System to be factory installed. Through this interface module, all Energy Management functions (specified in Energy Management Section) shall be performed. See Building Automation and Automatic Temperature Control System Specifications. The interface module with necessary controls and sensors shall all be factory mounted (not field mounted). Bacnet.

B. Control Functions: Occupied/unoccupied mode, conditioning mode set points, discharge air set point adjustment, and alarm shutdown

C. Diagnostic Functions: Include supply fan status, filter status, outside air damper status.
D. Provide capabilities for Boolean Processing and trend logs as well as "templated" reports and logs.

3. EXECUTION

7.21 EXAMINATION

A. Contractor shall verify that proper power supply adequate to supply the unit.

7.22 INSTALLATION

A. Contractor shall install in accordance with manufacturer's instructions.

7.23 MANUFACTURER'S FIELD SERVICES

A. Factory authorized start up commissioning only.
B. The contractor shall furnish manufacturer complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.
C. Low Ambient Compressor Lockout - Compressor operation shall be disabled below a user defined outdoor air temperature.
D. Unit status report - For each OAU unit, the BAS shall provide an operating status summary of all sensed values (zone temperature, discharge temperature, etc.) setpoints and modes.
E. Supply Air Tempering - When the unit is in the heat mode, but not actively heating, outdoor air heat set point will continue heat operation to maintain a minimum discharge air heating temperature setpoint and prevent heater cycling.

H. HYDRONIC SPECIALTIES

(1) Manufacturers

Subject to compliance with the specified and scheduled requirements the following manufacturers will be considered, but not limited to:

Hoffman
Amtrol/Thrush
Armstrong/Aurora
Bell & Gossett
Patterson
Taco
Victaulic
Wheatley

(2) Air Release Tank

The air release tank shall be of the in-the-pipe-line type with flanged tangential openings for inlet and outlet connections. The inside shall be specifically designed to create a low velocity vortex for the separation of free air from the water stream. The tank shell shall be rated at 125 PSI working pressure and shall be constructed with the ASME code for unfired pressure vessels and shall be so certified and stamped. The tank shall be equipped with a bottom drain connection and expansion tank/vent connection. Tank shall be line sized. Tank shall not have a strainer.

(3) Expansion Tank

The tank shall be constructed in accordance with the ASME Code for unfired pressure vessels and shall be suitable for 125 PSI water working pressure and 340ºF maximum water temperature. The tank shall be a pre-charged, heavy duty butyl rubber diaphragm-type pressure vessel complete with standard tire charging valve. Refer to the plans for mounting orientation. Capacities shall be as scheduled on the drawings.

(4) Suction Diffusers

Provide at the inlet of each base mounted pump, a suction diffuser as manufactured by Bell and Gossett, Victaulic, Thrush, or approved equivalent. Each suction diffuser shall be equipped with a disposable fine mesh start-up strainer and an adjustable support foot to carry weight of inlet piping. Victaulic Series 731 G, W731G, Bell and Gossett Suction Diffuser, or equal.

(5) Flexible Connections

Provide at the inlet and discharge side of each base mounted pump, at each connection to major equipment requiring vibration isolation and where shown on plans, a flexible connector, Metraflex Metrasphere or Engineer approved equal. Flexible connectors shall be of the flexible neoprene and nylon or EPDM and suitable for 225 PSI working pressure and 230°F temperature. Couplings shall be installed per the manufacturer's recommendations, in close proximity to the source of the vibration.

Alternatively, in lieu of a flexible connector, three (3) Victaulic Style 77 flexible couplings may be used on suction side and discharge side of base mounted pumps (six Victaulic flexible couplings per pump).

(6) Pressure Reducing Valve

Provide at the point of connection of the domestic water line to the hydronic system and where shown on the plans, a pressure reducing valve by Thrush, Bell and Gossett, or Engineer approved equivalent. Such pressure reducing shall be provided with an inlet strainer and shall be set to maintain a pressure of 4 PSI in excess of that at the highest point in the hydronic system. Each pressure reducing valves shall be line sized.

(7) Manual Air Vents

Provide, where shown on the plans, at each rise in piping and where required for proper purging of the geothermal system provide manual air vents.

(8) Automatic Air Vents

Provide, where shown on the plans, automatic air vents.

Alternatively, in water piping systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and as required for the elimination of expansion loops. (In accordance with Victaulic recommendations and as approved by the Engineer). Where expansion loops are required in Victaulic piping systems, use Victaulic flexible couplings on the loop(s).

2. FACTORY START-UP REPORTS

B. Provide factory start-up on site by a factory representative (not a third party contractor) for all HVAC equipment, including pumps, VFD's, heat pumps, etc. Submit factory start-up reports to the Engineer. The Mechanical Contractor and the Controls Contractor shall have a representative on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action taken shall be submitted to Engineer.

C. At a minimum, the report submitted to the Engineer shall include the following data:

(1) Water Source Heat Pumps

a. High voltage power supply is correct and accordance with the unit nameplate.
b. The phasing of the unit is correct per the compressor rotation.
c. The field wiring and circuit protection is the correct size.
d. The low voltage control circuit wiring is correct per the unit wiring diagram.
e. The piping system is clean and complete.
f. Verify water flow is established and circulating through all units.
g. The condensate line is properly sized, run, trapped and pitched.
h. The indoor blower turns freely without rubbing.

Start-up checklist and log: Upon unit start-up, the following items shall be checked and logged for each water source heat pump. Note, the items listed below must be verified/checked before the system is put into full operation:

i. Entering fluid temperature (heat and cool mode)
j. Leaving fluid temperature (heat and cool mode)
k. Temperature differential (heat and cool mode)
l. Return air temperature (heat and cool mode)
m. Supply air temperature (heat and cool mode)
n. Water coil heat exchanger (water pressure "in" – psig) (heat and cool mode)
o. Water coil heat exchanger (water pressure "out" – psig) (heat and cool mode)
p. Pressure differential (psig) (heat and cool mode)
q. Compressor amps
r. Compressor volts
s. Compressor discharge line temperature (after 10 minutes)
t. Refrigerant charge (oz.)
u. Test drain pan operation
v. Check and note strainer condition.

w. Check and note filter condition.

(2) Outside Air Units/Energy Recovery Units

a. Fan rotation
b. Recovery wheel rotation
c. Confirm all wiring connections are correct
d. Confirm all field wiring is correct
e. Adjust belt tensions and alignments
f. Confirm pipe connections are correct
g. Confirm sequence of operation is correct
h. Confirm damper operation

(3) Water-to-Water Heat Pumps

a. High voltage power supply is correct and accordance with the unit nameplate.
b. The phasing of the unit is correct per the compressor rotation.
c. The field wiring and circuit protection is the correct size.
d. The low voltage control circuit wiring is correct per the unit wiring diagram.
e. The piping system is clean and complete.
f. Verify water flow is established and circulating through all units.

Start-up checklist and log: Upon unit start-up, the following items shall be checked and logged for each water source heat pump. Note: The items listed below must be verified/checked before the system is put into full operation.

g. Source entering fluid temperature (heat and cool mode)
h. Source leaving fluid temperature (heat and cool mode)
i. Load entering fluid temperature (heat and cool mode)
j. Load leaving fluid temperature (heat and cool mode)
k. Temperature differential (heat and cool mode)
l. Water coil heat exchanger (water pressure “in” –psig) (heat and cool mode)
m. Water coil heat exchanger (water pressure “out” – psig) (heat and cool mode)
n. Pressure differential (psig) (heat and cool mode)
o. Compressor amps
p. Compressor volts
q. Compressor discharge line temperature (after 10 minutes)
r. Refrigerant charge (oz.)
s. Check and note strainer condition.

3. WATER TREATMENT

B. SCOPE

Provide a one-year water treatment program for the DTS/DTR; HPS/HPR, GS/GP water loop systems. The one-year period shall start from the date of substantial completion.

The program shall minimize corrosion, scaling, and prevent biological fouling of the piping system.

C. QUALIFICATIONS

Chemicals, service, and equipment shall be supplied by a single water treatment company for undivided responsibility. The water treatment chemical and service supplier shall be a recognized specialist, active in the field of commercial/industrial water treatment for at least 5 years, whose major business is in the field of industrial water treatment. The water treatment company shall have regional water analysis laboratories, service department, and full time representatives located within the trading area of the job site or facility.

Water treatment company shall be Bluegrass Kesco, Nalco, American Water Treatment.

D. SERVICE

Provide quarterly field service and Owner consultation. System water or fluid shall be tested for proper chemical parameters, clarity, and biological activity. If needed, provide chemical addition. Provide any laboratory and technical assistance required to achieve a successful program.

E. CHEMICALS

Provide one year's supply of the recommended chemical for scale and corrosion protection of the closed loop recirculating system. If needed, provide separate chemical to control microbiological growth in the system. Formulations shall not contain any ingredients which are harmful to system materials of construction.

F. EQUIPMENT

(1) Bypass Feeder

Provide one 5 gallon bypass chemical feeder for each system (DTS/DTR) and (GS/GR, HPS/HPR). Neptune DBF-5HP or approved equivalent.

(2) (DTS/DTR) and (GS/GR, HPS/HPR) Loop Filter.

Harmsco HIF or WB series fluid filter. Refer to schedule on the drawings for selection. Provide with a total of three sets of filter cartridges.

G. REPORTS

A summary of water or fluid quality and treatment shall be provided in writing to the Owner and Engineer after each quarterly site visit. Results of quarterly biological activity tests shall also be provided to the Owner and Engineer.

4. GEOTHERMAL AND HEAT PUMP SYSTEM CLEANING

B. GENERAL

The heating/cooling system for this contract is a hydronic heat pump system and there are several precautions which must be observed during its installation. The Contractor is advised to read all of the manufacturer's instructions prior to commencing the installation.

C. SYSTEM START-UP

The Contractor shall include as a part of his work a factory system fill and start-up by an authorized Factory Representative of the unit manufacturer.

D. CLEANING AND FLUSHING HYDRONIC HEAT PUMP PIPING SYSTEMS

(1) During construction, extreme care shall be exercised to prevent all dirt and other foreign matter from entering the pipe or other parts of the system. Pipe stored on the project shall have the open ends capped and equipment shall have all openings fully protected. Before erection, each piece of pipe, fitting or valve shall be visually examined and all dirt removed.

(2) After the system is complete it shall be thoroughly cleaned before placing in operation to rid the system of dirt, biological contamination, piping compound, loose mill scale, oil and any and all other material foreign to the water.

(3) Before chemical cleaning and sterilization of the entire system, the loop field shall be flushed and purged until free of dirt, debris, and air. During the chemical cleaning and sterilization process the supply and return run-outs shall be temporarily connected together at each heat pump location.

(4) After purging of the field loop the Contractor shall add an approved system cleaning solution at the recommended concentration to the entire system. Circulate the system with cleaner for the time recommended by the chemical manufacturer. After prescribed circulation time, flush the system until cleaner is removed.

(5) After chemical cleaning, the entire system shall be sterilized. Introduce a solution of sodium hypochlorite to achieve a chlorine residual of 25 to 50 ppm. Maintain this chlorine level for 12 to 24 hours. Flush out system until chlorine residual in system equals that of the makeup water.

(6) After the system has been completely cleaned and sterilized as specified herein, the individual heat pumps shall be connected permanently to the supply and return runouts and the system filled for operation under normal closed loop conditions. Within 48 hours of the completion of the sterilization implement a water treatment program to passivate all metal surfaces.

5. HVAC SYSTEM START-UP PROCEDURE

B. GENERAL

(1) The goal of this procedure is for a few units to run as much as possible with the coils as cold as possible to "wring out" the water and allow it to drain away in the condensate drain pans. Allowing all units to cycle on and off, running for short periods of time, does not dehumidify the air in the building. Starting the system without following the steps outlined will raise the relative humidity in the building and most likely cause condensation on some of the building surfaces and HVAC system that the Contractor will be responsible to correct.

(2) The high humidity and condensation occurs in school buildings at start up primarily because the building is only partly occupied (or not occupied) when the HVAC system is started. Most people believe that the answer to this problem is to turn the thermostats down very low. The assumption is that cold air will not hold moisture. That is not true. What happens is that the thermostats are quickly satisfied thermally because there is very little cooling load on the building and the cooling equipment. The terminal units then only have to run for a very short period of time to keep the thermostats satisfied and the relative humidity of the air is in fact raising. The goal is to cause the moist air to pass over coils which are cooling it and drying it without allowing more moist air to be introduced into the building.

(3) To reduce the always present high humidity start-up problem, we have devised this start-up procedure that will minimize the adverse effects of the start-up. As the building sits at start-up, all of the walls, floor, and ceilings are saturated with moisture from the air and also moisture is being released from the drying paint and curing concrete and mortar.

(4) The following procedure will slowly bring down the temperature and humidity in the lightly loaded building. It will also allow the HVAC equipment to more closely match the actual building load without students and equipment in use.

To reach these goals we require the following:

(1) Set 1/3 of the units (approximately every third unit) on 74°F (no lower). Set the other thermostats for a cooling setpoint of 90°F so the units will not cool. Override the controls so that the fans in all units will circulate air.

(2) Leave all of the interior doors open to allow the air to mix throughout the building.

(3) Close all exterior windows and doors.

(4) Turn off all exhaust fans and outside air units. Outside air unit exhaust and outside air dampers shall be closed.

(5) Leave all of the lights on in the building to provide a cooling load.

(6) Provide portable electric heaters or dehumidifiers in any room that shows signs of condensation.

Here is a list of things you should not do:

(1) Do not prop the exterior doors open during construction or while moving in furnishings.

(2) Do not start all of the units until students are starting school. When students start school the normal setpoints, schedules, and fan cycling shall begin.

END OF SECTION 23 02 00

SECTION 23 03 00 - CONDENSATE DRAINAGE SYSTEM (FOR COOLING EQUIPMENT)

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this section of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

   B. The Contractor shall provide a complete condensate drainage system to carry all condensate discharge from all cooling equipment from the building. Condensate system shall be installed in accordance with IMC. Provide condensate overflow switch for all condensate producing equipment.

   C. Pipe installation and fabrication shall be in accordance with the section of these specifications entitled PIPE, PIPE FITTINGS AND PIPE SUPPORT and as hereinafter specified.

   D. All piping shall be installed concealed, unless specifically noted otherwise and shall be installed under slabs or underground only when specifically indicated.

   E. Lines installed in ceiling spaces shall be held at the maximum possible elevation and shall be coordinated with all other trades to avoid conflicts.

   F. Condensate drain lines shall be pitched 1/4 inch per foot and installed with cleanout plugs at each change in direction and/or at thirty (30) foot intervals. Where this minimum pitch cannot be attained, contact Engineers.

   G. Horizontal runs of condensate drain lines shall be supported at six (6) foot intervals maximum, or more frequently where required to prevent sags and low spots.

   H. Lengths of horizontal lines shall be held at a minimum due to potential lint collection.

   I. Provide condensate traps in accordance with the manufacturer’s recommendations.

2. MATERIAL

   A. Refer to Section of these Specifications entitled: PIPE, PIPE FITTINGS AND SUPPORT.

3. INSULATION

   A. Refer to Section of these Specifications entitled: INSULATION - MECHANICAL.

END OF SECTION 23 03 00

SECTION 23 08 00 - FUNDAMENTAL COMMISSIONING OF HVAC

To be bid under separate contract. Commissioning Agent will work directly with Upper Dublin School District

1. GENERAL

1.1. DESCRIPTION

A. General provisions and other mechanical systems are specified in other Sections of Division 23.

B. Commissioning is an ongoing process and shall be performed throughout construction. Commissioning requires the participation of Division 23 to ensure that all systems are operating in a manner consistent with the Contract Documents. Division 23 shall be familiar with the commissioning plan issued by the Commissioning Agent (CA) as it applies to the work of Division 23 and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

C. Commissioning shall conclude with the completion of all required deferred testing, training and system documentation as specified and required to ensure the proper operation of the mechanical equipment and systems provided by this Division.

D. This Section covers mechanical systems commissioning, as required to demonstrate that the equipment and systems of Division 23 are ready for safe and satisfactory operation, as defined by project documents. Commissioning shall include, but shall not be limited to, identification of piping and equipment, cleaning, lubrication, start-up, check-out, and testing, adjusting, and balancing of systems, preparation of equipment and systems documentation and of maintenance and operation manuals, Owner training, and preparation of record drawings.

1.2. QUALITY ASSURANCE

A. The mechanical contractor shall identify a mechanical commissioning supervisor. The mechanical commissioning supervisor should have a minimum of ten years experience in mechanical contracting. The mechanical commissioning supervisor shall become familiar with the design intent and the requirements of the commissioning process as defined in this Section. The mechanical commissioning supervisor shall attend all commissioning meetings and coordinate the commissioning schedule as outline by the commissioning agent. The mechanical commissioning supervisor shall assist the CA in coordinating and executing the required commissioning activities.

1.3. MECHANICAL CONTRACTOR RESPONSIBILITIES

A. The mechanical commissioning supervisor shall be responsible for scheduling, supervising, and coordinating the startup, testing and commissioning activities as specified herein with the CA. Specific requirements of the mechanical contractor and

associated subcontractors are identified in this Section and in other Sections of this Division.

B. Mechanical commissioning shall take place in three phases. Commissioning requirements for each phase are as follows:

1. Construction Phase

a. Contractor shall attend a Commissioning Scoping meeting and additional commissioning meetings as required throughout the commissioning process. These commissioning meetings will be monthly during early construction and may increase in frequency to weekly during the start-up, prefunctional and functional testing phases. Contractor shall assure that all subcontractors who have commissioning responsibilities attend the Commissioning Scoping meeting and other commissioning meetings, as appropriate, during the construction process.

b. Contractor shall report in writing to the CA at least as often as commissioning meetings are scheduled concerning the status of his activities as they affect the commissioning process, the status of each discrepancy identified, the prefunctional and functional testing process, explanations of any disagreements with the identified deficiencies, and proposed resolution and schedule.

c. Contractor shall provide the CA with normal cut sheets and shop drawing submittals of equipment that is to be commissioned.

d. Contractor shall provide documentation to the CA for development of pre-functional and functional performance testing procedures, prior to normal O&M manual submittals. This documentation shall include detailed manufacturer installation, start-up, operating, troubleshooting and maintenance procedures; full details of any owner-contracted tests; fan and pump curves; full factory testing reports, if any; and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent. The Commissioning Agent may request further documentation necessary for the development of functional performance testing and the commissioning process. This data request may be made prior to normal submittals.

e. Contractor shall develop and submit to CA, for review prior to equipment or system startup, a complete startup and initial checkout plan using manufacturer’s start-up procedures. The commissioning agent shall conduct their own pre-functional testing check in parallel with the contractors.

f. Contractor shall review the commissioning agent's pre-functional checksheets and sign-off on the appropriate areas when contractor and sub-contractors are complete. The prefunctional test sheets will be developed by the commissioning agent. Only when each portion of the pre-functional test sheet is signed off will the contractor be able to move onto the next phase of the start-up and check-out.

g. Contractor shall provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review.

h. Contractor shall assist in clarifying the proposed operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

i. CA shall prepare the specific functional test procedures as specified herein. The contractors shall review the CA's proposed functional performance test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

j. Commissioning agent shall prepare a preliminary schedule for Division 23 commissioning activities, to include pipe and duct system testing, flushing and cleaning, equipment start-up, and TAB start and completion, for use by the CA and shall update the schedule as appropriate. The contractor shall update the commissioning activities and notify any delays in the progress meetings. Contractor shall notify the CA during the commissioning meetings when commissioning activities not yet performed or not yet scheduled will delay construction.

k. Mechanical equipment start-up shall not be initiated until the complete sign-off of the pre-functional check-sheets as developed by the commissioning agent as specified in other Sections of Division 23.

l. Contractor shall provide startup testing for all HVAC equipment, including the building automation control system and shall execute the mechanical-related portions of the prefunctional checklists for all commissioned equipment during the startup and initial checkout process. The commissioning agent shall conduct an independent start-up once the contractor is complete with their requirements.

m. Contractor shall perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.

n. Contractor shall correct current A/E punch list and CA deficiency items before functional performance testing can begin. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air or water related systems.

o. The commissioning agent shall generate the functional testing procedure and provide record to the mechanical contractor. The mechanical contractor shall review and provide support to the functional testing process. Contractor shall operate chillers, pumps, etc and systems in accordance with the CA requirements, open and close disconnects and switch normal and emergency power requirements as directed by the commissioning agent and the functional testing procedures.

p. Contractor shall report in writing to the CA at least as often as commissioning meetings are being scheduled concerning the status of each outstanding discrepancy identified during commissioning, prefunctional and functional performance testing. Report shall include description of the identified discrepancy, explanations of any disagreements, and proposals and schedule for correction of the discrepancy.

2. Acceptance Phase. Contractor shall assist and cooperate with the CA in the commissioning process by:

a. Putting all HVAC equipment and systems into operation and continuing the operation during each working day of the test and balance and commissioning effort, as required.

b. For a given area, have all required prefunctional checklists, calibrations, startup and selected functional tests of the mechanical system and associated controls completed and approved by the CA prior to beginning the test and balance process.

c. Provide a qualified technician to operate the controls as required to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.

d. Provide a TAB representative to assist the CA on conducting a random 10% check of the air and water distribution requirements.

e. Including cost of sheaves and belts that may be required to obtain required equipment performance, as measured by the test and balance effort.

f. Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug.

g. Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.

h. Installing a P/T plug at each water sensor that is an input point to the Control System.

i. Providing skilled technicians to execute starting and operation of equipment.

j. The commissioning agent will conduct functional performance testing. The contractor may be required to have a skilled technician present during functional testing although it is suggested that one be available to make adjustments or assist in problem-solving.

k. The commissioning will require full and part load performance verifications as well as seasonal and simulated testing requirements. The contractor shall be prepared to operate different components of various systems (example, chilled water and hot water systems to generate loading strategies) during the functional testing.

l. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA and A/E.

m. Prepare O&M manuals according to the Contractor Documents, including clarifying and updating the original sequence of operation to as-built conditions.

n. Maintain on site redline as built drawings and produce final “As-built” drawings for all project drawings and contractor-generated coordination drawings. List and clearly identify on the as-built drawings the locations of all airflow stations and sensor installations that are not equipment mounted.

o. Provide specified training of the Owner’s operating personnel in accordance with the commissioning agent’s overview and outline.

p. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

q. Provide updated diagrammatical logic for all TAB adjustments to the system.

3. Warranty Period. During the warranty period, the contractor shall:

a. Be available during seasonal or deferred functional performance testing conducted by the CA, according to the specifications.

b. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

1.4. TAB CONTRACTOR RESPONSIBILITIES

1. Six weeks prior to the starting of the T&B, submit to the commissioning agent, the qualifications of the site technician(s) for the project, including three (3) names of contractors and facility managers of recent projects on which the personnel were in charge. The Owner and CA will approve the site technician for this job.

2. Three months prior to the start of the TAB, the TAB Contractor shall submit a plan and approach for each system. The plan shall be reviewed by the CA for review and approval. The submitted plan shall include:
   a. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system
   b. An explanation of the intended use of the building control system.
   c. All field check-out sheets and logs to be used that lists each piece of equipment to be tested adjusted and balanced with the data cells to be gathered for each.
   d. Final test report forms to be used during this process
   e. Detailed step by step procedures for TAB work for each system and issue: terminal flow calibration, diffuser proportioning, branch and submain proportioning, total flow calculations, rechecking diversity issues.
   f. List all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of each of the test procedures, parameters and formulas to be used.
   g. Details of how total flow will be determined (Air: sum of terminal flows via BMS calibrated readings or via hood, pitot tube or flow stations. Water: pump curves, circuit setters, flow station, ultrasonic, etc,
   h. The identification and types of measurement instruments to be used and their most recent calibration date.
   i. Specific procedures that will ensure that both air and watersides will be operating at there lowest possible pressure at the point where the system will operate.
   j. Confirmation that the TAB contractor understands the outside air ventilation criteria under all conditions and how this will be measured during normal, economizer and unoccupied conditions.
   k. Details of how building static, room static and exhaust fan capacity will be checked.
   l. Proposed selection points for traverse measurement locations on the as-built documents. Review the placement of the HVAC measurement devices for proper straight runs and accuracy.
   m. Plan for formal progress reports including scope and frequency
   n. Plan for formal deficiency reports including scope and frequency.
3. TAB contractor shall attend commissioning meetings as directed by the commissioning agent and the GC.
4. TAB contractor shall communicate in writing to the controls contractor and the commissioning agent all setpoint and parameter changes made or problems and discrepancies identified during the TAB process that would affect the control loop system set-up and operation.

5. Submit written report of discrepancies, deficit or uncompleted work by others, contract interpretation requests and list of completed tests to the CA at least once per week.
6. After the TAB plan is accepted and two-weeks prior to TAB work, the commissioning agent shall conduct a pre-balancing conference. Prior to the prebalancing conference, the TAB contractor shall inspect the system readiness for testing and balancing. The TAB contractor shall prepare a list of deficiencies and uncompleted work that will affect the TAB process. This list shall be submitted to the commissioning agent and the GC.
7. If applicable, the TAB contractor shall coordinate testing of the fume hood systems with the CA and the owner's environmental health and safety organization.
8. The TAB contractor shall review the projected schedule and provide, in writing, to the CA and GC any delays in the schedule and what items will require completion prior to the TAB work.
9. The CA agent shall conduct independent verification of 100% of air and water end-devices for acceptance after the TAB contractor states in writing that they are complete with Testing & Balancing. The TAB contractor shall provide a mechanic to assist the CA in this verification and shall include this in the scope and price of the Work.
10. The TAB agent shall submit the TAB report to the commissioning agent for his review and comment. All data contained shall be re-verified in the field by the commissioning agent. A minimum of ten percent of the airflow readings shall be verified by the commissioning agent using his own equipment. All selection points shall be random. Total airflow shall be verified on all mains in the supply and the exhaust ducts.

2. PRODUCTS

2.1. SYSTEMS TO BE COMMISSIONED

A. The following are systems to be commissioned.

1. Building Automation System
2. Outside Air Energy Recovery Units
3. Heat Pumps-10%
4. Exhaust Fans
5. Split System Units (Indoor/Outdoor)
6. Geothermal Well Field Pumps (ALT)
7. Building Pumps Base Bid Boiler/Tower
8. Boiler/Tower and associated pumps
9. Kitchen Makeup Air Unit and Hoods

10. Dishwasher Exhaust Fan
11. Emergency Storm Shelter Items (Fan, Battery Backup, Etc.)

2.2. TEST EQUIPMENT

A. All standard testing equipment required to the mechanical portion startup, initial checkout shall be provided by the contractor responsible for the equipment or system being tested. This includes TAB and controls verification.

B. The commissioning agent shall perform their own system verification and performance check-out. The commissioning agent shall provide their own calibrated equipment as required for this testing.

C. All testing equipment associated with functional performance verification and point-to-point required by the commissioning agent shall be the responsibility of the commissioning agent.

D. Special equipment, tools and instruments (only available from vendor or specific to a piece of equipment) required for the functional testing of that equipment, according to the requirements of the contract documents and the functional test procedures shall be provided to the CA by the installing contractor and shall become the property of the Owner at project completion as indicated in the specification.

E. Proprietary test equipment and software required by any manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide test equipment, demonstrate its use and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon successful completion of the commissioning process as required in the specifications.

3. EXECUTION

3.1. SUBMITTALS

A. Division 23 shall provide submittal documentation relative to commissioning as required in this Section Part 1.

3.2. STARTUP PLAN AND PREFUNCTIONAL TESTING

A. The mechanical contractor and associated subcontractors shall be responsible for the installation of complete systems and sub-systems, fully functional, meeting the design objectives of the Contract Documents. Contractor shall follow the approved start-up, initial checkout, and prefunctional testing procedures. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility to the commissioning agent or Owner.

B. Prefunctional testing as directed and performed by the commissioning agent shall be required for each piece of equipment to ensure that the equipment and systems are properly installed and ready for operation so that functional performance testing may proceed without delays. Sampling strategies shall not be used for prefunctional testing. The prefunctional testing for all equipment and subsystems of a given system shall be successfully completed and documented prior to functional performance testing of the system. The mechanical contractor and sub-contractors shall sign off on the CA's pre-functional test sheets that they are complete and the system is ready. The commissioning agent will verify and conduct their own independent verification and start-up in parallel to the contractor's verification. Any deficiencies identified during this process shall be noted and reviewed by the contractors. Start-up and functional testing shall not proceed until all the deficiencies are corrected and verified by the commissioning agent.

C. The following procedures shall apply to all equipment and systems to be commissioned.

1. Start-up and Initial Checkout Plan. The Commissioning Agent shall develop the detailed start-up and prefunctional testing plans for all scheduled equipment. The primary role of the CA in this process shall be to review the installation for construction completeness and ensure that all components have been installed as per the design documents. Only when pre-functional testing is complete and signed off by all contractors, shall the equipment be start-up by the contractor. Equipment and systems to be commissioned are identified in this Section Part 2.

2. The start-up and initial checkout plan shall consist of the following as a minimum:

a. The manufacturer's standard written start-up and checkout procedures copied from the installation manuals and manufacturer's normally used field checkout sheets. The plan shall 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.

b. First-run checklist for equipment, to include:

1) Equipment properly set.

2) Alignment of shafts and couplings.

3) Adjustment of vibration isolators.

4) Piping and equipment properly connected.

5) Completion of initial lubrication procedures.

6) Clean filters in place, as appropriate.

7) Wiring properly connected.

8) Electrical overload relays appropriate for load.

9) Electrical accessories properly installed and adjusted.

10) Controls, safeties, and time switches properly calibrated and set-up

11) Verification of direction of motor rotation after final electrical connections by jogging motor.

12) Measurements of ampere draw of electric motors and comparison with nameplate rating and with overload heater ratings.

3. The Commissioning Agent shall determine which trade is responsible for executing and documenting each of the line item tasks and note that trade on the form. Each form may have more than one trade responsible for its execution.

4. The Contractor shall submit the startup reports to the CA for review.

D. The CA shall review and approve the procedures and the format for documenting them, noting any procedures that need to be added.

E. Two weeks prior to startup, the contractor shall schedule startup and checkout with the Owner and CA. The execution of the startup and checkout shall be directed and performed by the contractor, in accordance with manufacturer's published procedures and with the approved procedures. The CA shall be present for the contractor's required startup and checkout of all systems and equipment to be commissioned.

F. Sensor Calibration. Calibration of all sensors shall be included as part of the prefunctional testing and listed on the appropriate test checklists and reports, according to the specified procedures and accuracies for the devices and systems being tested.

G. All contractor responsible start-up, checkout forms shall be completed and submitted to the CA for review.

3.3. FUNCTIONAL PERFORMANCE TESTS

A. Functional Performance Verification (FPV) is the dynamic testing of systems (rather than just individual components) under full, part and seasonal requirements. Systems are tested under various loads and control sequences, such as low cooling and heating loads, component failures, unoccupied modes, fire alarm, etc. The systems are run through all the control sequences of operation and components are verified to be responding as the design intent and documents. Functional performance verification shall include; testing all sequences of operations,

verification of system capacity, generating simulated signals to simulate sensor values, conducting simulated conditions to tests all loads and verify system performance during all conditions of operation and verifying design intent. In addition, each system shall be tested through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part and full load). Proper responses such as power failures, freeze conditions, low-oil pressures, equipment failures, etc. shall also be tested. The commissioning authority develops the functional test sheets and procedures in sequential written form, coordinates the testing, conducts the testing and documents the testing. Each contractor is required is supply personnel to assist during the functional performance testing where applicable.

B. No system, equipment or component thereof shall be tested until the contractor and the GC has certified, in writing, that the system, equipment and / or components are complete, have been tested, adjusted and balanced and are ready for validating and performance testing. Functional Performance Verification is scheduled by the commissioning agent after the pre-functional testing requirements are complete and signed-off by the GC and the CA. Functional Performance Verification will not be conducted until a written notice of completion by the GC confirming that the system is ready for FPV. The air balancing and water balancing must be complete and the controls must be debugged prior to the performance verification.

C. Functional testing shall be conducted by the commissioning agent. Functional testing may not proceed until the systems have been properly installed, started-up and all deficiencies have been corrected.

D. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CA and GC. Beginning system testing before full completion shall not relieve the Contractor from fully completing the system, including all prefunctional checklists.

E. The contractor shall provide personnel to operate the systems while functional performance testing is commencing. This shall include but not be limited to; starting and stopping of systems, opening and closing valves to create false loads on the system (with the capabilities of the existing system) and allowing the commissioning agent to manipulate the building automation systems to modulate the system requirements.

F. The contractor shall review the commissioning functional performance testing procedure supplied by the commissioning agent. After functional testing commences, the contractor and the commissioning agent shall sign the functional test record and provide the owner and the GC a copy to review. All deficiencies either corrected in the field or outstanding shall be documented on the functional test forms for review by all parties.

G. All Functional Testing must be completed and approved by the commissioning agent and the owner before the project will be considered substantially complete.

3.4. DEFERRED TESTING

A. Deferred Testing. The contractor shall be available to assist in seasonal testing (Summer, Winter and Intermediate), tests delayed until weather or other conditions building construction is completed, required building occupancy or loading, or other conditions are suitable for the demonstration of equipment or system's performance, as specified. These deferred tests shall be conducted in the same manner as the seasonal tests as soon as possible. Deferred testing shall be executed, documented and deficiencies corrected as specified herein for functional performance testing. Any adjustments or corrections to the O&M manuals and "As built" documents required by the results of the testing shall be made before the seasonal testing process is considered complete.

3.5. TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

A. The commissioning agent shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the testing form or on an attached sheet. The testing form and any outstanding deficiencies shall be provided to the GC / Owner within two days of test completion. The CA shall review the contractor's startup testing reports and shall submit either a non-compliance report or an approval form to the contractor. The CA shall work with the contractor and others as necessary, to correct and retest deficiencies or uncompleted items. The contractor shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report with a Statement of Correction on the original non-compliance report. When all requirements are satisfactorily completed, the CA shall recommend approval of the startup and prefunctional testing of each system and schedule the functional testing of the equipment or system.

B. As functional performance testing progresses and a deficiency is identified, the CA shall discuss the issue with the executing contractor and the commissioning team.

1. When there is no dispute of the deficiency and the contractor accepts responsibility for correcting it, the CA shall document the deficiency and the contractor's response and intentions and the testing shall proceed, if possible. Corrections of minor deficiencies identified may be made by the contractor during the functional performance testing, at the discretion of the CA. Every effort shall be made or expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the commissioning effort.

2. When the identified deficiency is corrected, the contractor shall sign the statement of correction at the bottom of the non-compliance form, certifying that the equipment is ready to be retested, and return the form to the CA. The CA shall schedule the retest of the equipment or system involved.

3. If there is a dispute about an identified deficiency, the CA shall document the deficiency and the contractor's response, and provide a copy to the contractor. Every attempt shall be made to resolve the dispute at the lowest management level possible. When the dispute resolution has been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-

compliance form and returns the form to the CA. The CA shall schedule the retest of the equipment or system involved. Final interpretive authority shall be the A/E. Final acceptance authority shall be the Owner.

C. During the functional performance testing of multiple units of similar equipment, the CA will test all of the installed equipment and components identified. If, under such a testing procedure, three or more, identical pieces of equipment (size along does not constitute difference) fail to perform to the requirements of the Contract Documents (mechanically or substantively) due to manufacturing defects not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CA. In such case, the contractor shall provide the CA with the following:

1. Within one week of notification from the CA, the contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CA within two weeks of the original notice.

2. Within two weeks of the original notification, the contractor shall provide the CA and the A/E a signed and dated, written explanation of the problem, cause of failures, etc. and proposed solution, including full equipment submittals for corrective or replacement equipment, if appropriate. The proposed solution shall not be for less than the specification requirements of the original installation.

3. When approved, two examples of the proposed solution shall be installed by the contractor and the CA shall schedule and conduct functional testing of the proposed solution. Upon completion of the functional testing of the proposed solution, the CA shall recommend the acceptance or disapproval of the proposed solution to the Owner.

4. Upon acceptance of the proposed solution by the Owner, the contractor shall replace or repair all identical items, at their expenses 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 of approval of the proposed solution.

D. Cost of Retesting

1. The cost for CA and/or Owner personnel to conduct the retesting of a functional performance testing requirements necessitated because a specific prefunctional or startup test item, reported to have been successfully completed, but found to be incomplete or faulty, shall be the responsibility of the contractor.

2. For a deficiency identified during the functional testing, not related to any prefunctional checklist or start-up fault, the CA and Owner shall direct the retesting of the equipment once at "no charge" for their time. However, all costs for any subsequent retesting shall be the responsibility of the contractor.

3. Items left incomplete, which later cause deficiencies or delays during functional testing may result in backcharges to the responsible party.

3.6. GEOTHERMAL WELL FIELD COMMISSIONING BY CxA

A. Assist the CxA in system verification and performance testing.
B. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of commissioned equipment.
C. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.
D. Notify the CxA a minimum of two weeks in advance of scheduled system start-up.
E. Provide drilling logs to CxA and Designer of Record.
F. Provide a complete set of as-built drawings and O & M manuals for review.
G. Confirm Delta Pressure for each zone. Calculate pressure drop and compare to actual.
H. Confirm Delta Temperature for each zone.
I. Observe static pressure test of well field for 6-week period.
J. Confirm well field flushing and purging velocities.
K. Verify grouting for 5% of wells.
L. Verify well depth for 5% of wells.

3.7. OPERATION AND MAINTENANCE (O&M) MANUALS

A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.

B. Division 23 shall compile and prepare documentation for all equipment and systems covered in Division 23 and deliver this documentation to the GC for inclusion in the O&M manuals, according to this section and prior to the training of owner personnel.

C. The CA shall receive a copy of the O&M manuals for review.

D. Operation and maintenance documentation, in hardback 3-ring loose-leaf binders except full size drawings and diskettes, shall cover all mechanical systems. Documentation shall include the following: operations and maintenance documentation directory; emergency information; operating manual; emergency information; maintenance manual; test reports; and construction documents.

E. The operation and maintenance documentation package shall be submitted as one comprehensive package to the Owner and CA before systems start-up and commissioning, and shall be updated, revised and completed during, and at completion of, commissioning.

3.8. TRAINING OF OWNER PERSONNEL

A. The mechanical commissioning supervisor shall be responsible for training coordination and scheduling of required training and for ensuring that all required

training is completed. The CA shall oversee the content and adequacy of the training of Owner personnel.

B. Prepare and submit a syllabus describing an overview of the program, describing how the program will be conducted, when and where meetings are to be held, names and company affiliations of lecturers, description of contents and outline for each lecture, and recommended reference material and outside reading. Obtain direction from the Owner on which operating personnel shall be instructed in each system. Proposed training schedules, materials, and lesson plans shall be submitted to the CA for review of the content and adequacy of the training of Owner personnel for commissioned equipment or systems.

C. Mechanical Contractor – the mechanical contractor shall have the following training responsibilities:

1. Provide the CA with training plan one week before the planned training.

2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment.

3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment.

4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the startup technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment is required. More than one party may be required to execute the training.

6. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

3.9. WRITTEN WORK PRODUCTS

A. Written work products of Contractors shall consist of the start-up and initial checkout plan and the filled out start-up, initial checkout and pre-functional checklists.

END OF SECTION 23 08 00

SECTION 23 11 00 - REGISTERS, GRILLES, DIFFUSERS AND LOUVERS

1. REGISTERS, GRILLES AND DIFFUSERS

   A. GENERAL

      Alternate R, G & D selections, other than manufacturers and models listed below, will be accepted, provided quality, function and characteristics are equivalent. Acceptable alternates are Price, Titus, Metalaire, Carnes, Anemostat, Kruegar, and Tuttle & Bailey. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes shall be selected by the Architect. If Architect elects not to select color, all colors shall be off-white. Factory color samples shall be submitted with shop drawings.

   B. SELECTION

      Refer to the Selections Scheduled on the Drawings.

2. LOUVERS

   A. GENERAL

      Alternate louver selections, other than manufacturer and model listed below, will be accepted, provided quality, function and characteristics are equivalent. Acceptable alternates are Ruskin, Air Balance, Airline, Airstream, Louvers and Dampers and Penn. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes shall be selected by the Architect unless scheduled otherwise.

   B. LINTELS

      Provide lintels above all louvers as required. Refer to the lintel schedule in Specification Section 201100.

   C. SELECTION

      Refer to the Selections Scheduled on the Drawings.

END OF SECTION 23 11 00

SECTION 23 12 00 - SHEET METAL AND FLEXIBLE DUCT

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Requirements-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein. Linx is an acceptable manufacturer for ductwork.

   B. This branch of the work includes all materials, labor and accessories for the fabrication and installation of all sheet metal work as shown on the drawings and/or as specified herein. Where construction methods for various items are not indicated on the drawings or specified herein, all such work shall be fabricated and installed in accordance with the recommended methods outlined in the latest edition of SMACNA's HVAC Duct Construction Standards, Metal and Flexible, and its subsequent addenda. HVAC duct systems shall be fabricated and installed in accordance with the SMACNA duct construction standards (SMACNA-HVAC and SMACNA-Seismic) including Appendix B of the Seismic Restraint Manual Guidelines for Mechanical Systems. These references and plate numbers shall be used by the Engineer for required sheet metal thicknesses and final acceptance of methods of fabrication, hanging, accessories, etc. All equipment furnished by manufacturers shall be installed in strict accord with their recommended methods.

2. PRESSURE VENTS

   A. Provide a pressure relief vent in the supply air ductwork at each air handling unit. It shall be located between the fan outlet and the first manual or automatic (i.e., fire, fire smoke, or any motorized) damper or closure device. It shall be sized to relieve the duct air pressure below the rated pressure construction of the ductwork and above the working pressure of the fan. Provide a vacuum relief vent in the return and/or outside air ductwork at each air handling unit. It shall be located between the air handling unit casing and the first manual or automatic damper or closure device. It shall be sized to relieve the duct vacuum below the rated construction of the ductwork and above the working negative pressure of the fan. Automatic fan shutdown upon damper closure shall not be an acceptable protection for either overpressure or vacuum conditions. All duct relief dampers shall be of the automatic resetting type unless otherwise noted.

3. FILTER RACKS

   A. If separate filter grilles are specified for an HVAC unit the Contractors shall remove any unit mounted filters and blank off the unused filter access opening with sheet metal and seal air tight.

4. WALL PENETRATIONS

A. Where ducts penetrate interior or exterior walls, the walls shall be sealed air tight. Refer to the sleeving, cutting, patching and repairing section of the specifications for additional requirements.

5. PROTECTION DURING CONSTRUCTION

A. All ductwork openings shall be covered during construction to prohibit dust and dirt from entering the installed ductwork, air handling unit, terminal devices, etc. Provide temporary filters on all return grilles and duct openings if the units are running prior to the building being satisfactorily cleaned. The Contractor shall pay for duct cleaning if precautionary measures are not taken.

6. LOW VELOCITY DUCTWORK

A. General (Low Velocity)

(1) Double turning vanes shall be installed in all square turns and in any other locations indicated.

(2) Provide "spin-in" type fittings for all round ducts serving supply air diffusers where the duct branches off the rectangular duct main. The spin-in fitting shall not penetrate farther than 40% into the duct width.

(3) Cross-break all ducts where any duct section dimension or length is 18" or larger.

(4) Air volume dampers shall be installed in each duct branch takeoffs and/or where indicated, whichever is more stringent. All such dampers shall be accessible without damage to finishes or insulation and shall be provided where required for proper system balance.

(5) Splitter dampers shall be provided in all rectangular supply air duct tees. Damper blade operator shall extend a minimum two inches thru the insulation.

(6) Unless otherwise dimensioned on the drawings, all diffusers, registers and grilles shall be located aesthetically and symmetrically with respect to lighting, ceiling patterns, doors, masonry bond, etc.

(7) Ducts shall be hung by angles, rods, 18 ga. minimum straps, trapezes, etc., in accordance with SMACNA's recommended practices. There shall be no less than one set of hangers for each section of ductwork. Where ductwork contains filter sections, coils, fans or other equipment or items, such equipment or items shall be hung independently of ductwork with rods or angles. Do not suspend ducts from perlins or other weak structural members where no additional weight may be applied. If in doubt, consult the structural engineer.

(8) Provide approved flexible connectors at inlet and outlet of each item of heating and cooling equipment whether indicated or not. Install so as to facilitate removal of equipment as well as for vibration and noise control.

(9) All ductwork connections, fittings, joints, etc., shall be sealed. Seal with "Duct Seal 321". Apply per manufacturer's recommendations.

(10) Duct dimensions indicated are required inside clear dimensions. Plan duct layouts for adequate insulation and fitting clearance.

(11) All angular turns shall be made with the radius of the center line of the duct equivalent to 1.5 times the width of the duct.

(12) Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA and/or as indicated. Test openings shall be placed at the inlet and discharge of all centrifugal fans, coils, VAV boxes, fan sections of air handling units, at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.

(13) Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panel at each fire damper located and sized so as to allow hand reset of each fire dampers. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. All access doors shall be 16"x16" or as high as ductwork permits and 16" in length.

(14) The Contractor who installs the sheet metal shall furnish to the Air Balancing Contractor, a qualified person to assist in testing and balancing the system.

(15) Locate all supply, return and exhaust diffusers and grilles in the locations shown on the architectural reflected ceiling plan.

(16) All fans and other vibrating equipment shall be suspended by independent vibration isolators.

B. Materials (Low Velocity)

(1) Ductwork, plenums and other appurtenances shall be constructed of the following:

a. Steel sheets, zinc coated, Federal Specification 00-S-775, Type I, Class E & ASTM A93-59T with G-90 zinc coating or aluminum alloy sheets 3003, Federal Specification AA-A-359, Temper H-14.

b. Exposed ductwork in finished spaces such as gymnasiums, etc., shall be dual wall ductwork.

(2) Ductwork, plenums and other appurtenances shall be constructed of the materials of the minimum weights or gauges as required by the IMC and SMACNA HVAC Duct Construction Standards - Metal and Flexible, or as follows whichever is more stringent.

	ROUND DUCT	RECTANGULAR DUCT	
DIA., INCHES	GAUGE	WIDTH, INCHES	GAUGE
3 TO 12	26	UP TO 12	26
12 TO 18	24	13 TO 30	24
19 TO 28	22	31 TO 54	22
29 TO 36	20	55 TO 84	20
37 TO 52	18	85 AND ABOVE	18

(3) Flexible ductwork which is uninsulated shall be corrugated aluminum. Use flexible ductwork only where indicated. No sections shall be greater than five feet in length. Ductwork shall be UL rated and in accordance with IMC.

(4) Insulated Flexible Duct (Use Only Where Indicated)

a. Owens/Corning or equivalent, 1 ½'' inch thick fiberglass insulation; flexible liner; with aluminum pigment vinyl vapor barrier facing. Insulated flexible duct shall meet Fire Hazards Standards of NFPA 90A and IMC, flame spread not to exceed 25, smoke develop and fuel contributed not to exceed 50 when tested in accordance with ASTM-E84. Minimum R-value of 6.0, tested in accordance with ASTM C177.71. Flexible duct may be used only for runouts and no sections shall be more than five feet in length.

b. When flexible duct is located in areas where it will be visible because the ceiling allows views to the ductwork above, the flexible duct shall be black. The black color shall be factory coloring and not field applied.

c. Flexible duct shall not be used in areas where there is no ceiling.

C. Double Wall Low Velocity Ductwork

(1) Install Double Wall Ductwork in the following areas:
a. Gymnasium
b. Lobbies (where exposed)
c. Above areas with partial ceilings or clouds.

d. Anywhere supply ductwork is installed exposed to view in spaces (other than mechanical rooms)
e. At all other locations indicated on drawings.

(2) Prior to purchase/shipment of the ductwork, manufacturer shall provide as part of the submittal process scaled, field coordinated Autocad drawings of the complete system to be furnished. Drawings will indicate all system components including fittings, ductwork and manifolds. Drawings shall be available in an electronic format.

(3) Furnish and install where indicated double wall duct. The double wall duct shall be Eastern Sheet Metal, United McGill, Semco or approved equivalent. The duct shall have an inner shell, a 1-inch layer of fiberglass insulation and an outer pressure shell.

(4) Ductwork outer shell shall be spiral, lock-seam construction fabricated from galvanized steel meeting ASTM-527 standard. Any ductwork exposed to view shall be constructed of G90 galvanized steel, 20 gauge, and shall be supported as required with aircraft cables and self-tightening locks. Ductwork shall be constructed as specified in LOW VELOCITY DUCTWORK.

(5) Inner shell for spiral pipe shall be a perforated inner liner. The inner liner shall have 3/32" perforation with an overall open area of 23%.

(6) Inner shell for spiral pipe shall be solid galvanized steel.

(7) Inner shell for fittings shall be galvanized steel. All fittings shall be manufactured by the same manufacturer as the spiral pipe. Fittings shall be constructed a minimum of 22 Ga.

(8) The fiberglass liner shall have a maximum thermal conductivity (k) factor of 0.27 btu per hour per square foot per degree Fahrenheit per inch thickness at 75 degree F ambient temperature.

(9) All double wall ductwork will be furnished with factory installed flanges equal to Eastern Sheet Metal Flange which shall consist of a 1.5 outer flange and an inner secondary flange which shall keep the inner flange concentric and eliminate inner wall connections. Flanges requiring inner couplings will not be allowed, no insulation shall be exposed to the airstream at the connections.

(10) All grille and register taps shall be factory manifolded. Field installed taps will not be allowed. Manifolded taps may be tack welded and caulked for appearance. Only taps for grilles and registers may be provided this way. All other fittings shall be full body welded.

D. Miscellaneous (Low Velocity)

(1) Flexible Connectors: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA Pamphlet No. 90-A; neoprene coated glass fabric; 20 oz. for low velocity ducts secured with snap lock.

(2) Turning Vanes: Barber-Colman, Titus, Waterloo, or equivalent; fabricated as recommended by SMACNA: noiseless when in place without mounting projections in ducts. All turning vanes shall be double blade type.

(3) Air Extractors: Metalaire Model 102-1 Carnes, Titus, Barb-Air or approved equivalent. Provide with operating hardware by Ventfabrics, Inc. Operator shall extend two inches from duct to allow for external insulation, where required. Regulator shall seal operator shaft air tight. Install hardware as recommended by manufacturer.

(4) Splitter Damper: Splitter damper shall be constructed of 16 gauge galvanized steel. Provide with operating hardware by Ventfabrics, Inc. to include damper blade bracket, ball joint bracket and operator shaft. Operator shall extend two inches from duct to allow for external insulation, where required. Regulator shall seal operator shaft air tight. Install hardware as recommended by manufacturer.

(5) Access Doors; In Ductwork: In ducts where indicated or where required for serving equipment, fabricated according to SMACNA recommendations and be equivalent to those manufactured by Air Balance, Vent Products or other approved equivalent. Provide a hinged access door in duct adjacent to all fire, smoke and control dampers for the purpose of determining position. Access doors shall also be provided on each side of duct coils (water, electric, steam, etc.), and downstream side of VAV boxes and CAV boxes. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise install as large an access door as height permits by 16" in length.

(6) Access Doors; In Ceilings or Walls: Titus, Krueger, Milcor or approved equivalent with key locks.

a. In mechanical, electrical or service spaces. 14 gauge aluminum brushed satin finish, 1" border.

b. In finished areas.
14 gauge primed steel with 1" border. To accept the architectural finishes specified for the space.

Provide where required to access equipment, dampers, valves, filters, etc.

(7) Volume Dampers (Rectangular): Ruskin, Model MD35 or Empco, Air Balance; Louvers and Dampers, Titus, Carnes, Cesco/Advanced Air, Creative Metals, United Air volume dampers. Frames shall be 4" x 1 "x 16 gauge galvanized steel. Blades shall be 16 gauge galvanized steel, maximum of 6" wide. Maximum single section size shall be 48" wide and 72" high. Provide with Ventfabrics 1" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

(8) Volume Dampers (Round): Ruskin, Model MDRS25 or, Empco, Air Balance; Louvers and Dampers, Titus, Carnes, Cesco/Advanced Air, Creative Metals, United Air Round Damper. Dampers shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20 gauge steel, 7" long. Damper blades shall be 20 gauge galvanized steel. Axle shall be 3/8" diameter steel. Provide with Ventfabrics 1" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

(9) Fire Dampers: Fire dampers shall comply with IMC and shall be constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1-1/2 or 3 hour fire protection rating as required by fire wall. Damper shall have a 165°F fusible link, and shall include a UL label in accordance with established UL labeling procedures. Fire damper shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing 16 gauge minimum steel sleeves, angles, other materials, practices required to provide an installation equipment to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions. All fire dampers shall be dynamic. Static fire dampers are not allowed. Provide velocity level and pressure level as required for application (if in doubt, contact Engineer). Fire dampers shall be Ruskin Type DIBD for 1-1/2 hour rating or Ruskin Type DIBD 23 for a 3 hour rating. Other acceptable manufacturers are Air Balance, Prefco, Greenheck, Nailor, or Safe Air. Provide an access door for fire damper reset at all fire damper locations.

7. HIGH VELOCITY DUCTWORK

A. Application (High Velocity)

(1) All Variable Air Volume system supply ductwork between the air handling unit and all Variable Air Volume terminals shall be high velocity ductwork. Branch supply takeoffs serving single Variable Air Volume terminals shall be permitted to be high velocity single wall ductwork.

(2) All Constant Air Volume system supply ductwork in a system utilizing Constant Air Volume boxes shall be high velocity double wall ductwork between the air handling unit and the Constant Air Volume boxes. Branch supply takeoffs serving single Constant Air Volume boxes shall be permitted to be high velocity single wall ductwork.

B. General (High Velocity)

(1) Provide flexible connectors at inlet and outlet of air handling equipment to accommodate a minimum of three times the operating pressure of the system.

(2) Duct dimensions indicated are required inside clear dimensions.

(3) All ductwork connections, fittings, joints, etc., shall be sealed. Seal with Hardcast "DT" tape and Hardcast "RTA-50" adhesive installed in strict accordance with manufacturers recommendations.

(4) Ductwork shall be installed per SMACNA Medium or High Pressure Manual, whichever is applicable. (Latest Edition shall apply.)

(5) All hanger straps shall be 18 ga. minimum with reinforcement angles installed in strict accordance with SMACNA. Flat oval ducts shall be installed with 2"x2"x1/4" angles on top and bottom ducts 18" wide and larger. Use 1"x1"x3/16" angles on ducts under 18" wide.

(6) Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA or the duct manufacturer, and/or as indicated. Test openings shall be placed at the discharge of all air handling units and at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.

(7) Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panels at each fire damper located and sized so as to allow hand reset of each fire damper. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. Where access doors are installed in insulated ductwork, the access door shall be the insulated type.

C. Materials (High Velocity Single Wall)

(1) All round and oval high velocity ductwork shall be United McGill "Uni-Seal" or "Uni-Weld" ductwork or Semco, Dixie, Eastern Sheet Metal, Langdon, or approved equivalent as required by pressure rating of the system.

(2) Ductwork shall be spiral, lock-seam type and be constructed of galvanized steel.

DIAMETER (Or Equivalent Round Diameter For Oval Ducts)	METAL THICKNESS
3-14 Inches	26 Ga.
15-26 Inches	24 Ga.
27-36 Inches	22 Ga.
37-50 Inches	20 Ga.
52-60 Inches	18 Ga.

All duct fittings shall be fabricated by duct manufacturer. Duct fittings shall be minimum 20 gauge. All fittings shall be a minimum of one gauge heavier than the pipe size.

D. Materials (High Velocity Double Wall)

(1) Furnish and install where indicated by drawings or specifications high velocity double wall duct. The double wall duct shall be United McGill Acoustic K27, SEMCO, Dixie or approved equivalent. The duct shall have a perforated inner liner. The inner liner shall have 3/32" perforation with an overall open area of 23% an intermediate layer of fiberglass insulation minimum 1 ½'' thick and an outer pressure shell. Duct shall be of spiral lockseam construction fabricated from galvanized steel meeting ASTM-A527 standard. The duct insulation shall have minimum R-value of 6.0. High pressure double wall fittings shall have the same construction features as the double wall duct. Duct shall be constructed of G90 Galvanized steel. Outer shell of ductwork shall be constructed of the minimum gauges specified above for single wall high velocity ductwork.

(2) All double wall ductwork will be furnished with factory installed flanges equal to Eastern Sheet Metal Flange which shall consist of a 1.5 outer flange and an inner secondary flange which shall keep the inner flange concentric and eliminate inner wall connections. Flanges requiring inner couplings will not be allowed, no insulation shall be exposed to the airstream at the connections.

E. Miscellaneous (High Velocity)

(1) Flexible Connectors: Duro-Dyne, Ventfabrics, U.S. Rubber or equivalent; conforming to NFPA Pamphlet No. 90-A or IMC, whichever is more stringent; neoprene coated glass fabric; 30 oz. for high velocity ducts secured with bolted angles.

(2) Fire Dampers: Fire dampers shall comply with IMC and be constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1, 2 or 3 hour fire protection rating as required by fire wall. Damper shall have a 165°F. fusible link, and shall include a UL label in accordance with established UL labeling procedures. Fire damper shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers in duct systems that are not equipped with any type of fire or smoke shutdown shall be Dynamic type. Fire dampers in duct systems that will shut down during a fire or smoke emergency shall be Static type. Provide velocity level and pressure level as required for application (if in doubt, contact Engineer). Fire dampers shall be installed in wall and floor openings utilizing 16 ga. steel sleeves, angles, other materials, and practices required to provide an installation equivalent to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions. Fire dampers shall be Ruskin Type IBD2, Style C, for a 1$\frac{2}{}$ hour rating or Ruskin IBD 23 for a 3 hour rating. Other acceptable manufactures are Air Balance, Prefco, Creative Metals, National Controlled Air or Safe Air. Provide an access door for fire damper reset at all fire damper locations.

(3) Access Doors; In Ceilings and Walls: Titus, Krueger, Milcor or approved equivalent; 14 gauge aluminum brushed satin finish; 1" border; all doors are to be furnished and

installed by the Mechanical Contractor. Provide with required to access air distribution equipment, dampers, etc., unless specified in architectural portion of the specifications.

(4) Access Doors; In Ductwork: All access doors in round or oval high velocity ductwork shall be screw and gasketed type. Screws shall be maximum 4 inches on centers. Access door sizes shall be as follows:

DUCT DIAMETER	OPENING SIZE
3-4 inches	4" x 10"
5-6 inches	6" x 10"
7-24 inches	10" x 16"
26-36 inches	16" x 16"
Over 36 inches	16" x 22"

F. Air Leakage Testing of the Ductwork Systems

(1) It is the intent of this section to insure the ductwork installed has minimal air leakage.

(2) Air leakage testing shall be accomplished by an AABC or NEBB certified company. Refer to the Test & Balance specifications.

(3) It is the intent to test all ductwork. The duct systems which will require testing are as follows:

a. Supply air duct systems serving VAV boxes.

b. All exhaust air duct systems associated with the outside air unit.

c. All make-up air duct systems.

(4) Do not insulate the supply air systems prior to testing.

(5) The maximum allowable supply air leakage rate is 2.5% of the systems design CFM when the ductwork is pressurized to 2.5” WG (Therefore, if a supply air system is tested, and the supply air fan rated capacity is 10,000 CFM, the allowable leakage is 250 CFM.) The maximum allowable return air and exhaust air leakage rate is 2.5% of the system design when the ductwork is pressurized to 1.50”WG.

(6) The entire supply air ductwork system shall be tested with some exceptions. On VAV systems, the high velocity ductwork upstream of the VAV boxes shall only be tested. Cap the duct at the inlet to the VAV box.

(7) All exhaust air sheet metal ductwork associated with the system shall be tested. Flexible ductwork shall not be tested. Cap the main duct prior to the central equipment fan connection. Also cap the branch ducts which serve the diffusers, after the round

branch air volume with sheet metal caps. Seal caps well to damper to avoid air loss at this location. This air loss, from the caps, is included in the noted leakage rate.

(8) The noted allowable leakage rate is the total allowable. It shall include leakage associated with the following:

a. All ductwork as described in above paragraphs.

b. Access doors

c. Volume dampers

d. Relief air doors

e. Smoke dampers

f. Fire dampers

g. Fire smoke dampers

h. End caps used to seal ducts

(9) If any duct system fails a test, the contractor shall reseal the system. It shall then be retested until the duct system meets the leakage allowment at no additional cost to the owner.

(10) Carefully select the ductwork construction requirements and the type of duct sealant to be used as required to meet the leakage allowances. The sheet metal duct pressure classification is a minimum only. The contractor shall select the appropriate sheet metal pressure classification, duct sealant class and duct sealant materials to meet the project air leakage allowances.

END OF SECTION 23 12 00

SECTION 25 01 00 - MOTOR STARTERS AND OTHER ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

1. MOTOR STARTERS-GENERAL

   A. Where motor starters are required for mechanical equipment they are to be the responsibility of the Contractor furnishing the equipment as outlined herein.

   B. Motor starters shall be furnished by the Equipment Supplier with his equipment. Coordinate all requirements for starters with equipment suppliers and other trades.

   C. Motor starters shall be NEMA style. I.E.C.-style starters are not to be provided. Their sizing and installation shall be coordinated with the equipment manufacturer's requirements and in accordance with the National Electrical Code.

   D. Unless otherwise noted, provide combination starter/disconnects for all equipment requiring a starter.

2. ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

   A. All mechanical equipment shall be provided for single point electrical connection unless specifically noted to the contrary. Refer to schedules and other sections of these specifications for further requirements. It is the responsibility of the Contractor to coordinate the electrical characteristics of all equipment with the electrical provisions indicated on the Contract Documents. The Contractor shall notify the Engineer in writing ten calendar days prior to bid of any discrepancy so a written clarification by Addendum may be made. If such notice is not given, the Contractor shall be responsible for any and all costs or delays associated with any changes required. Specification of equipment characteristics made during review of shop drawings shall not relieve the Contractor of this responsibility.

   B. The equipment manufacturer shall provide internally mounted fuses with his equipment, as required, to comply with the U.L. listing on the equipment name plate. (i.e., hermetically sealed compressors or equipment with name plate data that recommends or requires fuse protection.) See also, National Electrical Code, Article 440, and other applicable sections of the N.E.C.

   C. It is the Contractor's responsibility to furnish and install fusible or non-fusible disconnect switches or circuit breakers for disconnecting means as required by the Code for all electrically powered equipment. All power wiring from source, thru disconnecting means and motor starters to motor terminals or equipment junction box is to be furnished and installed by the Contractor. Each separate contractor engaged for the project shall coordinate with all other trades to ensure all necessary equipment and labor is included for fully functioning mechanical systems, installed per code requirements. Unless otherwise notes, provide combination starter/disconnects for all equipment requiring a starter.

D. Final electrical connection of equipment shall be verified for proper voltage requirements in conjunction with the motor nameplate patch and actual wiring configuration. Any costs associated with damage to appliances motors, equipment, etc., connected to incorrect supply voltage shall be borne by the Contractor.

E. Refrigeration condensing units with internal compressors shall be furnished with integral starter. The Contractor is to furnish and install a fusible disconnecting mains with fuses sized to motor nameplate requirements. Coordinate wiring, mounting and style of disconnect switch at unit in field.

F. All interlock or other control wiring, unless specifically noted otherwise, is the responsibility of the Contractor.

G. All equipment shall be suitably enclosed. All enclosures for equipment shall be rated and approved for the environment in which it operates. (i.e., NEMA 1, NEMA 3R, NEMA 7, NEMA 12, etc.) Verify the requirement with the installation condition if not indicated on the plans.

H. Observe the following standards for manufacturers of equipment and selection of components.

(1) Starters, control devices and assemblies: NEMA, U.L. - (I.E.C. style not acceptable)

(2) Enclosures for electrical equipment: NEMA, U.L.

(3) Enclosed switches: NEMA, U.L.

(4) All electrical work, generally: National Electrical Code

(5) All electrical work in industrial occupancies: J.I.C. standards

(6) All electrical components and materials: U.L. listing required.

I. Where required, the Contractor is to provide mounting rails or channels to install starters with code-required clearances. Framing shall be solidly anchored by welding expansion shields in masonry or other approved anchorage. Frames are to be constructed of steel angles or pre-manufactured channel systems such as Unistrut, Kindorf or B-Line Company. Framing material shall be pre-finished with corrosion-resistant material or painted with two coats corrosion-resistant oil-based enamel.

3. REQUIREMENTS FOR MECHANICAL EQUIPMENT, 1/2 H.P OR LESS

A. This section describes requirements for small mechanical equipment such as (but not limited to) package terminal heating/cooling units, (water source heat pumps, etc.) VAV

boxes, unit heaters, vertical and horizontal unit ventilators, exhaust fans, in-line fans, fan coil units, cabinet heaters and the like.

B. Small equipment with motor(s) of 1/2 H.P., single phase or less are generally not required to be furnished with NEMA-style starter(s), unless otherwise noted.

C. For such equipment, provide integral contactor or horsepower-rated relay where controlled by thermostat or other type of switch. Contactors or relays shall be as recommended by the manufacturer of the equipment, suitable for the service duty.

D. Provide transformer within unit as required to derive low voltage A.C. for thermostat control or derive from temperature controls panel, if available.

E. Provide internal fusing for unit motor and other loads in fuse block or in-line fuseholder. See also Article 2-B, this Section.

F. Where externally-mounted disconnecting means is required and would be impractical, unsightly or inappropriate in the judgment of the Engineer, disconnects shall be located within the unit. These

disconnects may be fusible H.P.-rated snap switches or manual starters with overload elements, as required. Locate this and other electrical equipment within enclosure where easily accessible behind access panel or door on unit, and as acceptable to the electrical inspector or local authority having jurisdiction. Refer to mechanical equipment schedules for further information.

G. Where fractional horsepower duplex pumps such as water circulators, sump pumps, etc. are provided, they shall be provided with alternators, cordsets, etc., as required for a complete installation.

4. REQUIREMENTS FOR MECHANICAL EQUIPMENT, 3/4 H.P. OR LARGER

A. This section describes requirements for mechanical equipment such as (but not limited to) exhaust fans, larger air handling units, cooling tower fans, water source heat pumps, chilled or hot water pumps, D.X. roof-top units, air compressors and the like.

B. Provide premium efficiency motors.

C. Equipment provided with motor(s) of 3/4 H.P. and larger, single or three-phase are required to be furnished with starters suitable for the load(s) specified. It is recommended that starters be furnished integrally with or mounted on equipment for field wiring by the Contractor. Where starters are furnished separate from equipment, furnish templates or rough-in diagrams to the appropriate contractor for his use in installation.

D. All starters shall be size 0 minimum. They shall be constructed and tested in accord with latest edition of NEMA standards. All starters shall be across-the-line magnetic type, unless indicated otherwise. On motors of 20 H.P. or greater rating, the supplier shall

provide starters capable of limiting inrush currents. These shall be of the wye-delta, reduced voltage open-transition type, or electronic controlled, as required. Do not utilize closed transition starters unless specifically indicated.

E. Magnetic starters shall be furnished with the following characteristics and accessories as a minimum. See other sections of these specifications and mechanical schedules for further requirements.

(1) Contacts shall be silver-alloy, double-break type. Contacts shall be replaceable without removal of wiring or removal of starter from enclosure. Number of contacts shall be as required for service indicated. Contacts shall be gravity dropout type, positive operation.

(2) Coil voltage shall be 120 volts, A.C., 60 HZ or less, as required to suit control systems available voltages. Coils shall be of molded construction, rated for continuous duty. Provide coil clearing contact as required.

(3) Provide control transformer of adequate K.V.A. as required on all starters with line-to-line voltages higher than 120 volts A.C. Provide fuse block and slow-blow fuse to protect control transformer per NEMA, N.E.C. and U.L.

(4) Provide hand-off-auto selector switch in face of starter, wired into hand and off switch positions. Auto position (if needed) to be field wired as indicated on plans or schedules for automatic control. Provide a green run pilot light.

(5) Provide NEMA Class 20 resettable overload relays, accurately sized to the motor nameplate rating of the motor served and the temperature differential between motor and controller. Overloads shall be easily replaceable, and resettable without opening enclosure, via a push
button or similar means. Class 10 or Class 30 overloads may be used, depending on the type of anticipated service.

(6) Provide at least one N.O. and one N.C. auxiliary contact (field-convertible to opposite operation) with each starter. Refer to mechanical details or schedules for additional requirements, if any. All starters shall have space for two additional single-pole contacts.

(7) All starters shall be thru-wiring type.

(8) Provide phase failure sensing relay to open starter coil circuit (on loss of one or more phases) on all three-phase starters controlling motors of 15 H.P. or larger.

(9) Provide power factor correction capacitors on motors of 15 H.P. or larger where predicted power factor based on manufacturer's data will fall below 0.90%. Capacitors shall be of the unit-cell type, in single enclosure with discharge resistors and tank overpressure circuit interrupter for safety.

5. REQUIREMENTS FOR WIRING

   A. All wiring, including controls, interlock, miscellaneous power, sensors, thermostats, etc., shall be installed in metallic raceway systems that are in compliance with all Division 26 requirements of these Specifications, unless specifically noted otherwise. Open cabling systems will only be permitted where specifically permitted within the Division 26 Specifications and if less than 50 volts A.C. peak-to-peak or 50 volts maximum D.C.

   B. Where open cabling is permitted, it shall be installed with proper support as specified in the Division 26 Specifications.

   C. Where open cabling is permitted, and installed in environmental air plenum (return, relief, supply, etc.), the materials installed shall be in compliance with N.E.C. Articles 700, 725, 770 (for fiber optic), 780 and 800.

   D. Where open cabling is permitted, it shall only be installed open in accessible spaces. Where concealed in walls, it shall be routed through raceways to outlet boxe(s) for the terminal device.

6. INVERTER DUTY MOTORS

   A. Motors which are controlled by variable frequency drive shall be:

      (1) NEMA MG-1 Part 31 rated for Inverter Duty.

      (2) Furnished with shaft grounding kit for all motors:

         a. Motors less than 100 HP in size shall be furnished with shaft grounding kit, Aegis SGR Bearing Protection Ring or equal. One shaft grounding ring and related hardware shall be provided on drive end or non-drive end of motor per manufacturer's instructions. These shall be factory mounted and installed on the exterior of the motor to allow for visual inspection. Ground motor frame per manufacturer's instructions. Install kit in strict accordance with manufacturer's instructions.

         b. Motors Pumps greater than 100 HP to 1000 HP in size shall be furnished with shaft grounding kit, Aegis SGR Bearing Protection Ring or equal. Provide shaft grounding ring on drive end and non-drive end of motor per manufacturer's instructions. Additionally provide insulated bearing journals to further reduce risk of current dissipation through bearings. Ground motor frame per manufacturer's instructions. Install kit in strict accordance with manufacturer's instructions.

END OF SECTION 25 01 00

SECTION 25 02 00 - CONTROLS – DIRECT DIGITAL

A. GENERAL

1. The Contractor shall furnish all labor, materials, equipment and services required to provide a complete web based temperature control system as specified and as shown on the plans.

2. Prior to the installation of or payment for any work, the Contractor shall prepare submittals which shall be reviewed by the Architect and Engineer. These submittals shall include a complete control diagram and sequence of operation of the entire system, plus engineering data on all devices used.

3. The Contractor shall be a licensed installer of HVAC temperature controls by a national temperature controls manufacturer. **Provide an alternate price for Conexus Tridium Niagra Controls.**

4. The system herein specified shall be free from defects in workmanship and material under normal use and service if, within twelve (12) months from the date of acceptance by the Engineer, any of the equipment herein described is proved to be defective in workmanship or material, it will be adjusted, repaired, or replaced free of charge by the Contractor.

5. All equipment, unless specified to the contrary, shall be fully proportioning and adjustable. The Control System shall consist of all room thermostats, air stream thermostats, valves, damper operators, relays, freeze protection equipment, dampers, panels, and other accessory equipment not provided with the equipment to fill the intent of the specifications and drawings.

6. Complete freeze protection equipment shall be provided at all required locations. Freeze protection thermostats shall have twenty foot elements and be capable of de-energizing the circuit when any point along the element reaches the set point of the thermostat. Freezestat elements shall be placed on the leaving side of each heating coil, so that every square foot on the heating coil is protected. On heating coils larger than eighteen (18) square feet, provide multiple freezestats wired in series. The Contractor shall insure that all freeze protection devices and equipment has been fully tested prior to the heating season and shall so certify in writing to the Engineers. The cost of replacement of equipment damaged by freeze-up caused by improper freeze protection or faulty control equipment shall be borne by the Contractor.

7. All controls shall reset automatically when power is restored after an outage.

8. Cabling:

    1. Cabling is required to be in conduit in walls in mechanical rooms, and any other exposed location. Conduit is not required in other locations. Cable is not required

to be plenum rated. Do not paint wiring. The Contractor is responsible for protecting wiring from paint.

2. Any wire that runs through a wall shall have a conduit sleeve with bushings on both ends.

9. All valves and dampers shall be capable of operating properly with the system pressures encountered. This shall include modulating and shut-off functions.

10. The Contractor shall also refer to the mechanical maintenance, HVAC equipment, and all other sections of the specifications for additional control requirements.

11. Provide smoke detectors and shut down control for all air handling units and combined air systems as required by the IMC. Duct smoke detectors shall be provided by the electrical contractor. Refer to electrical drawings for duct smoke locations. Controls contractor shall coordinate with the electrical contractor for low voltage control wiring for unit shut down.

12. All DDC controllers or control modules shall have covers to protect the circuit boards. All wiring shall be anchored securely within 6" of the controller.

13. Provide all control dampers, valves, etc. not supplied with the equipment or required to accomplish the sequences specified.

14. The Contractor shall provide all refrigeration control and interlock wiring as recommended by the equipment manufacturer.

15. Wiring and required conduit in connection with the control system(s), including power wiring of any voltage, shall be installed by the Contractor. The Contractor may, at his option, engage the Electrical Contractor to accomplish this work. It is emphasized however, that the Contractor is finally responsible for all such work. Refer to color chart on electrical drawings for wiring and conduit color information.

16. Electric power for the control panels, modules, unit controller, damper motors, etc., shall be derived from the building electric system. Power shall not be derived from the HVAC equipment power source or equipment low voltage transformers (internal or integral).

17. The electrical work required for the installation of the control system(s), shall be provided by the Contractor in accordance with all National and Local Electrical Codes. All wiring shall be concealed except in Mechanical Rooms. All electrical work specified under this division of the specifications shall also comply with Division 26 of these specifications.

18. All exterior electrical work, equipment, etc. shall be waterproofed in appropriately NEMA rated boxes.

19. Controls system and all related components shall comply with ASHRAE Standard 135 (BACnet protocol).

B. DDC GENERAL REQUIREMENTS

1. Each temperature control zone and all controlled or monitored equipment shall be furnished with a graphic.

2. Each AHU shall have full graphic showing all damper positions, all air temperatures throughout the AHU (RA, mixed air, preheat, cooling, etc.), OA CFM, EWT/LWT and all valve and damper positions.

3. Provide graphics of each piping network showing valve positions, equipment status, and temperatures.

4. All % readings shall all be listed as % open.

5. All DDC system functions, points, graphics, etc. shall be accessible from CMTA's office. Provide all passwords and support required.

C. CONTROL SYSTEM CHECKOUT AND TESTING BY CONTROLS CONTRACTOR PRIOR TO DEMONSTRATION AND ACCEPTANCE

1. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have representative present during any of all startup testing.

    a. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 250200.
    b. Verify that control wiring is properly connected and free of shorts and ground faults.
    c. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
    d. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
    e. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
    f. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated. Submit log to Engineer for review.
    g. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
    h. Alarms and Interlocks
        a. Check each alarm with an appropriate signal at a value that will trip the alarm, and that all alarms can be remotely reset.

b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

D. CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE TO ENGINEER

1. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified in Control System Checkout and Testing. Provide Engineer with log documenting completion of startup tests. Submission of log is required before Demonstration and Acceptance may begin.

   a. Engineer will be present to observe and review system demonstration. Schedule with Engineer at least 14 days before system demonstration begins. Systems balancing shall be complete prior to demonstration, coordinate scheduling with TAB agency accordingly.
   b. Demonstrate actual field operation of each sequence of operation as specified in these specifications. Provide and operate test equipment required to prove proper system operation.
   c. Demonstrate all alarms, including external alarms to Owner selected phones, e-mail accounts, etc. Also demonstrate fire alarm system interface.
   d. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.
   e. Provide all required tools to perform system demonstration and point calibration (drills, duct plugs, thermometers, hygrometers, hand-held carbon dioxide sensors, aerosol test smoke, 2-way radios, water probes, DP sensors for water and air, etc.)

E. ONE YEAR OPTIMIZATION PERIOD

1. The controls contractor shall provide assistance to the Engineer for a period of one year from date of system acceptance for the purposes of optimizing the systems for energy efficiency and occupant comfort. The assistance shall consist of the following:

   a. Assist the Engineer in accessing the controls system remotely.
   b. Input schedules and setpoints for all zones and equipment as requested by Engineer and Owner.
   c. Trend points as requested by Engineer.
   d. Modify controls sequences as requested by Engineer. No additional points will be added by the Engineer.
   e. Modify setpoints and schedules as requested by Engineer and Owner.

   Additionally during the optimization period, include 2 site visits (6 hours on-site each) for system modifications that cannot be accomplished remotely.

F. OWNER'S TRAINING

1. The Contractor shall provide full instructions to designated personnel in the operation, maintenance, and programming of the system. The training shall be specifically oriented to the system and interfacing equipment installed. Eight hours of Owner Training shall be provided at substantial completion, again after 6 months and again 1 year after substantial completion. The Contractor shall prepare a written agenda for Owner Training. The agenda must be reviewed and approved by the Engineer prior to initial Owner Training. The Owner Training shall include an overview of the entire HVAC system operation, temperature sensor setpoint manipulation, critical alarm training, graphics display overview, and Owner action summary (printed) for critical alarms. In addition, all other training, explanations, discussions, submittals, etc., deemed necessary for Owner Training by the Engineer shall be provided. The Owner Training session will not be an explanation of the “Controls” by the controls subcontractor. Owner Training shall be an integrated systems seminar representative of the building systems provided by the Contractor. Subcontractors shall be present during Owner training sessions.

2. The Contractor shall provide a Sign-in Sheet and Meeting Minutes of the training. The Contractor shall also video tape the initial training sessions. Complete Operations and Maintenance Manuals shall be reviewed by the Contractor during training.

G. SOFTWARE AND CONTROLS

1. The design of the BAS shall network operator workstations and stand-alone DDC Controllers. The network architecture shall consist of multiple levels for communication efficiency, a campus-wide (Management Level Network) Ethernet network based on TCP/IP protocol, high performance peer-to-peer building level network(s) and DDC Controller floor level local area networks with access being totally transparent to the user when accessing data or developing control programs.

2. The BAS shall provide a web based graphical interface that allows users to access the BAS data via the Internet, extranet, or Intranet. The interface shall use HTML based ASP pages to send and receive data from the BAS to a web browser. All points, graphics, and data collection shall be similar to the other schools, with similar installations, not part of this contract, for the features stated.

3. The web server module will be supplied by this contractor.

4. The BAS contractor shall provide the necessary interface software and labor to connect the points of this DDC network to a new DDC to allow for alarm conditions to be sent to the schools maintenance department. No additional pagers are required. All alarm points, delay times, and response recording shall be similar to the other schools of like size within this school system. Refer to the control specifications for owner preferred alternate and the acceptable manufacturers for base bid.

5. The web-based interface shall provide the following functionality to users, based on their access and privilege rights:

- Logon Screen – allows the user to enter their user name, password and Domain name for logging into the web server.
- The Alarm Display – a display of current BAS alarms to which the user has access will be displayed. Users will be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages, and informational and memo text. Any alarm acknowledgements initiated through the web interface will be written to the BAS central workstation activity log.
- Graphic Display – Display of system graphics, including animated motion, available in the BAS workstation will be available for viewing over the web browser. Software that requires creation of dedicated "web" graphics in order to display them via the browser interface will not be acceptable. A graphic selector list will allow users to select any graphics to which they have access. Graphic displays will automatically refresh with the latest change of values. Users will have the ability to command and override points from the graphic display as determined by their user accounts rights.
- Point details – users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access rights.
- Point Commanding – users will be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface will be written to the BAS central workstation activity log.
- Scheduling – allows users to create modify, override or delete existing schedule of reports, zones and trend collection depending on their current user privileges.
- Run Reports Option – allows users to run and print a pre-configured report through a web interface client.
- Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the Owner as required to support the web access feature.

H. EQUIPMENT

1. CONTROL PANEL(S) (FACTORY MOUNTED CONTROLLERS ON ALL EQUIPMENT WHERE APPLICABLE)

a. Each system shall be provided with a local panel for mounting of all relays, switches, controllers, and thermometers associated with that system. Where one cabinet will not accommodate all the equipment necessary for one system, a second cabinet shall be mounted and bolted adjacent to it. Cabinets shall be provided with a 2/3's door. All devices shall be provided with lamacoid plastic nameplates for identification.

b. HVAC Mechanical Equipment Controllers shall be a 12-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors.

c. The HVAC Mechanical Equipment Controllers shall provide a RS-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.

d. HVAC Mechanical Equipment Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.

e. Each HVAC Mechanical Equipment Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all components. The HVAC Mechanical Equipment Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
f. In the event of the loss of normal power, there shall be an orderly shutdown of all HVAC Mechanical Equipment Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
g. Should HVAC Mechanical Equipment Controller memory be lost for any reason, the user shall have the capability of reloading the HVAC Mechanical Equipment Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
h. Terminal Equipment Controllers: Factory mounted Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, allowing for interface to a variety of modulating actuators. Terminal equipment controllers shall be used for heat pumps, ERUs, and VAV boxes. These controllers will be supplied by this equipment manufacturer and installed at the factory. This contractor will coordinate with the unit manufacturer to determine if an additional enclosure is required. If required, this contractor shall provide and install as necessary to protect the digital controller.

2. CONTROL PANEL SOFTWARE FEATURES

a. The software programs specified in this Section shall be provided as an integral part of DDC and HVAC Mechanical Equipment Controllers and shall not be dependent upon any higher level computer for execution.
b. HVAC All points shall be identified by up to 30 character point name and 16 character point descriptor. The same names shall be used at the PC workstation.
c. The DDC and HVAC Mechanical Equipment Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
d. A single process shall be able to incorporate measured or calculated data from any and all other DDC and HVAC Mechanical Equipment Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC and HVAC Mechanical Equipment Controllers on the network. Database shall support 30 character, English language point names, structured for searching and logs.
e. The Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
f. The Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC and HVAC Mechanical Equipment Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms

from being lost. At no time shall the DDC and HVAC Mechanical Equipment Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.

g. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC and HVAC Mechanical Equipment Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point

h. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary. The entire collection process shall be automated so that the data collection definition, amount of data to be collected, collection report and scheduling take the form a wizard, or online assist utility, in order to complete this process within a short amount of time for a large group of points. Ability to produce a summary of changes in a log file.

i. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC and HVAC Mechanical Equipment Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided. Each DDC and HVAC Mechanical Equipment Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing data samples. All trend data shall be available for transfer to a Workstation without manual intervention.

j. The peer to peer network shall allow the DDC and HVAC Mechanical Equipment Controllers to access any data from or send control commands and alarm reports directly to any other DDC and HVAC Mechanical Equipment Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC and HVAC Mechanical Equipment Controllers shall send alarm reports to multiple workstations without dependence upon a central or intermediate processing device. The peer to peer network shall also allow any DDC and HVAC Mechanical Equipment Controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.

3. THERMOSTATS

A. GENERAL

1) All thermostats shall have a "warmer-cooler" slide. This control shall allow the space occupants to reset the temperature up or down a predetermined amount. This amount or no amount at all, shall be adjustable thru the BAS, and have the capability to limit the upper and lower limits of this setting.

2) The thermostat shall have an unoccupied override button

3) The thermostat shall have an integral thermometer.
4) All thermostats provided for the project shall be similar in size and appearance to the other thermostats utilized within this school system for continuity.
5) Provide programming to lock out control of wall mounted thermostats selected by the Owner.
6) All thermostats shall be mounted on a plastic base or other insulating material to prevent wall coupling effect.
7) Thermostats shall be mounted with the top at a maximum of 48" A.F.F. and shall be mounted to comply with A.D.A.
8) All thermostats should be provided with clear lockable thermostat guards. BAPI – Guard BA/BG2 or equal.

4. DAMPERS

a. Several louvers of practical widths shall be provided for larger dampers. Modulating dampers shall have opposed blades. Dampers shall have edge and end seals. Dampers shall be Ruskin CD-60 or better. Maximum leakage rate shall be 2 CFM per square foot at 1" W.G. pressure differential for dampers greater than 12" wide. Leak rate for dampers 12" and less shall be 3 CFM per square foot. NOTE: Do not mount outside air dampers so close to water coils, piping, etc., that freeze-up may occur due to a leaky damper.

5. RELAYS AND SWITCHES

a. Relays and switches shall be of the positive and gradual acting type and shall be furnished and installed as required for the successful operation of the system. All switches shall have suitable indicating plates.

6. VALVES

a. All valves shall be of the fully modulating and silent type unless otherwise specified. They shall provide accurate control of the heating or cooling medium under all load conditions. All valves 2-inches or smaller shall have brass or bronze bodies with screwed ends. Valves 2-1/2 inches and larger shall have iron bodies, brass or bronze trimming with flange ends. Valves shall be normally open or normally closed as required. Valves shall be installed with the stem in the upright position or as recommended by the valve manufacturer. The pressure drop across any valve shall not exceed 5-PSI.

7. DUCT MOUNTED TEMPERATURE AND HUMIDITY SENSORS

a. All temperature sensors shall have a range of +20 degf to +120 degf monitoring range. These sensors may be resistive or thermistor based. The accuracy on these sensors shall be +/- 5%. All humidity sensors shall be bulk polymer type measuring 0-100% humidity and outputting a signal of 4-20 mA. The accuracy of this sensor shall be +/- 5%.

8. ELECTRONIC AIRFLOW MEASURING STATIONS

   a. All Stations – each insertion station shall contain an array of velocity sensing elements and straightening vanes. The velocity sensing elements shall be of the RTD or thermistor type. The sensing elements shall be distributed across the duct cross section in a quality to provide accurate readings. The resistance to airflow through the airflow measurement station shall not exceed 0.08 inches water gage at an airflow of 2,000 fpm. Station construction shall be suitable for operation at airflow of up to 5,000 fpm over a temperature range of 40 to 120 degrees F, and accuracy shall be plus or minus 3 percent over a range of 125 to 2,500 fpm scaled to air volume. Each transmitter shall produce a linear, temperature compensated 4 to 40 mA DC, output corresponding to the required velocity pressure measurement.

9. DAMPER ACTUATORS

   a. Damper actuators shall be Brushless DC Motor Technology with stall protection, bi-directional, fail safe spring return, all metal housing, manual override, independently adjustable dual auxiliary switch.
   b. The actuator assembly shall include the necessary hardware and proper mounting and connection to a standard ½" diameter shaft or damper blade.
   c. All actuators having more than 100 lb-in torque output shall have a self-centering damper shaft clamp that guarantees concentric alignment of the actuator's output coupling with the damper shaft. The self-centering clamp shall have a pair of opposed "v" shaped toothed cradles; each having two rows of teeth to maximize holding strength. A single clamping bolt shall simultaneously drive both cradles into contact with the damper shaft.
   d. All actuators shall be designed and manufactured using ISO900 registered procedures, and shall be Listed under Standards UL873 and CSA22.2 No. 24-93 I.

10. CURRENT SENSING RELAY (STATUS DETECTION)

   a. Provide solid-state, adjustable, current operated relay. Provide a relay which changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.
   b. Adjust the relay switch point so that the relay responds to motor operation under load as an "on" state and so that the relay responds to an unloaded running motor as an "off" state. A motor with a broken belt is considered an unloaded motor. Provide a status device for all fans and pumps.

11. DEMONSTRATION

   a. A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall demonstrate on-site with the Owner and Engineer that all points and sequences operate as designed.

The warranty does not start until all controls, graphics, points, etc. are functioning.

All controls functioning on _____Date

Witnessed by _____

12. SEQUENCE OF CONTROL – Refer to Construction Documents for controls drawings and sequences. For each system listed, provide the sequence of control as stated and a color graphic with mapped points, alarms, etc.
13.
    A. Refer to the controls drawings, specifications, and attached revisions sheet for controls strategy for ERU-1 and the spaces it serves.
        I. Provide CO2 sensor for Gymnasium 124, Media Center 117, Art 419, Music 417 and Cafeteria 133.
        II. Gymnasium shall be provided with fully modulating motorized damper to achieve the sequence below.
        III. These spaces will operate on a demand control ventilation strategy refer to the controls sequence below.
        IV. Provide DP sensor in the outside air ductwork that ERU-1 fan VFDs will use to ramp up and down to vary airflow to spaces.

1. <u>Variable air volume (vav) / constant air volume (cav) boxes</u>

1.1. vav/cav boxes and modulating damper are used to supply outside air and are not utilized for conditioning purposes. airflow cfm for each box shall be monitored by the ddc control system. an air flow sensor shall be located on the inlet side of the vav/cav boxes. all boxes shall operate with pressure independent controls. provide damper position point (% open) for all boxes. provide co2 level (ppm) for each vav box zone.

1.2 in unoccupied mode the vav/cav box dampers shall be 100% closed.

1.3 occupied mode:

1.3.1 provide carbon dioxide sensor inside the breathing zone for each vav box. vav box damper shall modulate as required to maintain 700 ppm (adj.) differential between zone indoor and ambient outdoor carbon dioxide levels. damper shall modulate as required to maintain differential. modulate damper open if actual ppm differential rises above differential setpoint. modulate damper closed if ppm level falls 60 ppm (adj.) below differential setpoint. modulate damper in 5% increments (adj.) with a 15 second (adj.) delay between each step. cfm shall be monitored and in no case shall maximum cfm on drawings be exceeded. provide the following points on each vav box graphic: maximum cfm, actual cfm, damper % open, zone co2 ppm, outside air co2 ppm, co2 ppm differential setpoint, actual co2 ppm differential.

1.3.2 cav box damper shall be 100% open to the balanced airflow setpoint.

CAV AND VAV BOX POINTS LIST								
DISPLAY NAME	BI	BO	BV	AI	AO	AV	ALARM TYPE	GRAPHIC
AIRFLOW				X			OUT OF RANGE	YES
AIRFLOW SETPOINT						X		YES
OCCUPANCY SENSOR				X				YES
OUTSIDE AIR CO2 PPM				X				YES
SCHEDULE			X					
ZONE CARBON DIOXIDE PPM				X			OUT OF RANGE	YES
ZONE CARBON DIOXIDE PPM SETPOINT						X		YES
ZONE DAMPER					X			YES
ZONE OVERRIDE						X		YES

END OF SECTION 25 02 00

SECTION 26 05 01 - GENERAL PROVISIONS - ELECTRICAL

1. GENERAL

A. The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub Contractor's work. Each Contractor is directed to familiarize himself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.

B. Refer to the Division 01 specifications for restrictions and guidelines regarding working hours.

C. The Contractor shall be governed by any alternates, unit prices and Addenda or other contract documents insofar as they may affect his part of the work. Refer to the Division 01 specifications for additional information regarding alternates.

D. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material and appurtenances and performing all operations necessary for the satisfactory installation of complete and operating electrical systems indicated on the drawings and/or specified herein.

E. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the electrical systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the drawings and specifications, shall be included as part of this Contract. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting his bid, it shall be understood that the Contractor has included the cost of all required items in his bid, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

F. It is not the intent of this section of the specifications (or the remainder of the contract documents) to make any specific Contractor, other than the Contractor holding the prime contract, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be done through the Contractor to the Architect (if applicable), then to the Engineer.

G. This section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise,

the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.

H. It is the intent of this Contract to deliver to the Owner a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials to be installed by other trades without additional cost to the Owner.

I. The Contractor shall provide interim life safety and fire detection measures as required by the Authority Having Jurisdiction, Division 1 specifications, NFPA, and applicable Codes. This includes temporary relocations of heat/smoke detection, exit signage, and egress lighting in existing buildings as applicable.

J. In general, and to the extent possible, all work shall be accomplished without interruption of the existing facilities' operations. Each Contractor shall advise the Architect, Owner and Engineer (as applicable) in writing at least one week prior to the deliberate interruption of any services. The Owner shall be advised of the exact time that interruption will occur and the length of time the interruption will occur. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.

K. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of his own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without request for extra compensation to the Owner, except where otherwise provided for in the contract document.

L. Definitions:

(1) Prime Contractor - The Contractor who has been engaged by the Owner in a contractual relationship to accomplish the work.

(2) Electrical Contractor - Any Contractor whether bidding or working independently or under the supervision of a General Contractor, that is: the one holding the Prime Contract and who installs any type of Electrical work, such as: power, lighting, television, telecommunications, data, fiber optic, intercom, fire detection and alarm, security, video, underground or overhead electrical, etc.

Note: Any reference within these specifications to a specific entity, i.e., "Electrical Contractor" is not to be construed as an attempt to limit or define the scope of work for that entity or assign work to a specific trade or contracting entity. Such assignments of responsibility are the responsibility of the Contractor or Construction Manager holding the prime contract, unless otherwise provided herein.

(3) Electrical Sub-Contractor - Each or any Contractor contracted to, or employed by, the Electrical Contractor for any work required by the Electrical Contractor.

(4) Engineer - The Consulting Mechanical-Electrical Engineers, either consulting to the Owner, Architect, other Engineers, etc.

(5) Architect - The Architect of Record for the project, if any.

(6) Furnish - Deliver to the site in good condition.

(7) Provide - Furnish and install in complete working order.

(8) Install - Install equipment furnished by others in complete working order.

(9) Contract Documents - All documents pertinent to the quality and quantity of all work to be performed on the project. Includes, but not limited to: Plans, Specifications, Addenda, Instructions to Bidders, (both General and Sub-Contractors), Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Construction Manager's Assignments, Architect's Supplemental Instructions, Periodical Payment Requests, etc.

2. INTENT

A. It is the intent of these specifications and all associated drawings that the Contractor provide finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete and ready for use."

B. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

3. ELECTRICAL DRAWINGS AND SPECIFICATIONS

A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Engineer for review before proceeding with the work. The Contract Drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Contractors shall, however, anticipate that additional offsets may be required and submit their bid accordingly.

B. The drawings and specifications are intended to supplement each other. No Contractor or supplier shall take advantage of conflict between them, or between parts of either, but should this condition exist, the Contractor or supplier shall request a clarification of the condition at least ten days prior to the submission of bids so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless

modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.

C. The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

D. The Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.

E. The Engineer shall reserve the right to make minor adjustments in location of conduit, fixtures, outlets, switches, etc., where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance.

F. The Contractor shall evaluate ceiling heights called for on Architectural Plans. Where the location of Electrical equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.

G. Special Note: Always check ceiling heights indicated on Drawings and Schedules and insure that these heights may be maintained after all mechanical and electrical equipment is installed. If a conflict is apparent, notify the Engineer in writing for instructions.

H. Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.

I. The drawings are intended to show the approximate location of equipment, materials, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions whether given in figures or scaled shall be verified in the field. In case of conflict between small and large scale drawings, the larger scale drawings shall take precedence.

J. The Contractor and his Sub Contractors shall review all drawings in detail as they may relate to his work (structural, architectural, site survey, mechanical, etc.). Review all drawings for general coordination of work, responsibilities, ceiling clearances, wall penetration points, chase access, fixture elevations, etc. Make any pertinent coordination or apparent conflict comments to the Engineers at least ten days prior to bids, for issuance of clarification by written addendum.

K. Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornament or other detail is indicated by starting only, such

detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

4. EXAMINATION OF SITE AND CONDITIONS

A. The Contractor shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. All Contractors or suppliers shall carefully examine all Drawings and Specifications and contract documents to determine the kind and type of materials to be used throughout the project and which may, in any way, affect the execution of his work.

B. The Contractor shall fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of temporary or permanent utilities, etc. The Contractor shall include in his work all expenses or disbursements in connection with such matters and conditions. The Contractor shall verify all work shown on the drawings and conditions at the site, and shall report in writing to the Engineer ten days prior to bid, any apparent omissions or discrepancies in order that clarifications may be issued by written addendum. No allowance is to be made for lack of knowledge concerning such conditions after bids are accepted.

5. EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor requests review of substitute materials and/or equipment, and when under an approved formal alternate proposal, it shall be understood and agreed that such substitution, if approved, will be made without additional cost regardless of changes in connections, spacing, service, mounting, etc. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall advise all such Contractors of the change and shall reimburse them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Special Note: Review of Shop Drawings by the Engineer does not absolve the Contractor of this responsibility

B. References in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Each Contractor, in such cases, may, at his option, use any article, device, product, material, fixture, form, or type of construction which in the judgment of the Engineer is equivalent to that specified, provided the provisions of paragraph (A) immediately preceding are met. Substitutions shall be submitted to the Engineer a minimum of ten days prior to bid date for approval to bid in written form thru addenda or other method selected by the Engineer. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.

C. Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the engineers.

D. The Contractor shall furnish along with his proposal a list of specified equipment and materials which he proposes to provide. Where several makes are mentioned in the Specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall have the right to choose any of the makes mentioned without change in price.

E. The Contractor shall review the contract documents and if a material substitution form is required for each proposed substitution, it shall be submitted per requirements.

6. SUPERVISION OF WORK

A. Each Contractor and Sub-Contractors shall personally supervise the work or have a competent superintendent on the project site at all times during progress of the work, with full authority to act for him in matters related to the project.

7. CODES, RULES, PERMITS, FEES, REGULATIONS, ETC.

A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, and other costs including utility connections or extensions, in connection with his work. As necessary, he shall file all required plans, utility easement requests and drawings, survey information on line locations, load calculations, etc., prepare all documents and obtain all necessary approvals of all utility and governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work.

B. Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.

C. The Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus or drawings required in order to comply with all applicable laws, ordinances rules and regulations, whether or not shown on drawings and/or specified.

D. All materials furnished and all work installed shall comply with the current edition of the National Electrical Codes, National Fire Codes of the National Fire Protection Association, the requirements of local utility companies, and with the requirements of all governmental agencies or departments having jurisdiction.

E. All material and equipment for the electrical systems shall bear the approval label, or shall be listed by the Underwriters' Laboratories, Incorporated. Listings by other testing agencies may be acceptable with written approval by the Engineer.

F. All electrical work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes

requested by the State Fire Marshal, as applicable or required. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.

G. The Contractor shall insure that his work is accomplished in accord with OSHA Standards and any other applicable government requirements.

H. Where conflict arises between any code and the plans and/or specifications, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at his own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

8. COST BREAKDOWNS/SCHEDULE OF VALUES

A. Within thirty days after acceptance of the Contract, the Contractor is required to furnish to the Engineer one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made on forms provided or approved by the Engineer or Architect. Payments will not be made until satisfactory cost breakdowns are submitted. Refer to the end of this section for a sample of expected level and breakout being required.

9. CORRECTION PERIOD

A. All equipment, apparatus, materials, etc., shall be the best of its respective kind. The Contractor shall replace all materials at his own expense, which fail or are deemed defective as described in the General Conditions. The effective date of completion of the work shall be the date each or any portion of the work is accepted by the Architect or Engineer as being substantially complete.

B. Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer, such as generators, engines, batteries, transformers, etc., shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

10. INSPECTION, APPROVALS AND TESTS

A. Before requesting a final review of the installation from the Architect and/or Engineer, the Contractor shall thoroughly inspect his installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled.

Failure to accomplish this may result in charges from the Architect and/or Engineers for unnecessary and undue work on their part.

B. The Contractor shall provide as part of this contract electrical inspection by a competent Electrical Inspection Agency, licensed to provide such services in the local jurisdiction. The name of this agency shall be included in the list of materials of the Form of Proposal by the Contractor. All costs incidental to the provision of electrical inspections shall be borne by the Electrical Contractor.

C. The Contractor shall advise each Inspection Agency in writing (with an information copy of the correspondence to the Architect and/or Engineer) when he anticipates commencing work. Failure of the Inspection Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.

D. Inspections shall be scheduled for rough as well as finished work. The rough inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.

E. Approval by an Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these plans and specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.

F. Before final acceptance, the Contractor shall furnish three copies of the certificates of final approval by the Electrical Inspector (as well as all other inspection certificates) to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

G. The Contractor shall test all wiring and connections for cross connects, continuity and grounds before equipment and fixtures are connected, and when indicated or required, demonstrate by continuity/load/voltage test and Megger Test the installation of any circuit or group of circuits. Where such tests indicate the possibility of faulty insulation, locate the point of such fault, replacing same with new and demonstrate by further test the elimination of such defect. The secondary service entrance conductors from the utility (source) transformer to the main service disconnecting means shall be megger tested. The results of this test shall be turned over to the engineer for review and approval. Any conductor failing the test shall be replaced and any costs associated shall be borne by the contractor.

11. COMPUTER-BASED SYSTEM SOFTWARE

A. For all equipment, controls, hardware, computer-based systems, programmable logic controllers, and other materials provided as a part of the work, software that is installed shall be certified in writing to the Engineer and Owner by the manufacturer and/or writer to be free of programming errors that might affect the functionality of the intended use.

12. CHANGES IN ELECTRICAL WORK

REFER TO GENERAL AND SPECIAL CONDITIONS.

13. CLAIMS FOR EXTRA COST

REFER TO GENERAL AND SPECIAL CONDITIONS.

14. SURVEYS, MEASUREMENTS AND GRADES

A. The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.

B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Engineer thru normal channels of job communication and shall not proceed with his work until he has received instructions from the Engineer.

15. TEMPORARY USE OF EQUIPMENT

A. The permanent electrical equipment, when installed, may be used for temporary services, subject to an agreement among the Contractors involved, the Owner, and with the consent of the Engineer. Should the permanent systems be used for this purpose, each Contractor shall pay for all temporary connections required and any replacements required due to damage without cost, leaving the equipment and installation in "as new" condition. The Contractor may be required to bear utility costs, user fees, etc.

B. Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

16. TEMPORARY SERVICES

A. The Contractor shall arrange for temporary electrical and other services which he may require to accomplish his work. In the absence of other provisions in the contract, the Contractor shall provide for his own temporary services of all types, including the cost of connections, utility company fees, construction, removal, etc., in his bid.

17. RECORD DRAWINGS

A. The Contractor shall insure that any deviations from the design are being recorded daily or as necessary on record drawings being maintained by the Contractor. Dimensions from fixed, visible permanent lines or landmarks shown in vertical and horizontal ways shall be utilized. Compliance shall be a requirement for final payment. Pay particular attention to the location of underfloor or underground exterior in-contract or utility-owned or leased service lines, main switches and other appurtenances important to the maintenance and safety of the Electrical System. Keep information in a set of drawings set aside at the job site especially for this purpose. Deliver these record drawings electronically to the Engineer in AutoCad 2000 format (or more recent version) along with the hand marked field set. Electronic bid drawings will be furnished to the Contractor for his use at the completion of the work.

18. MATERIALS AND WORKMANSHIP

A. All electrical equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. All workmanship shall be first-class and shall be performed by electricians skilled and regularly employed in their respective trades. The Contractor shall determine that the equipment he proposes to furnish can be brought into the building(s) and installed within the space available. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s).

B. All conduit and/or conductors shall be concealed in or below walls, floors or above ceilings unless otherwise noted. All fixtures, devices and wiring required shall be installed to make up complete systems as indicated on the drawings and specified herein.

C. All materials, where applicable, shall bear Underwriters' Laboratories label or that of another Engineer-approved testing agency, where such a standard has been established.

D. Each length of conduit, wireway, duct, conductor, cable, fitting, fixture and device used in the electrical systems shall be stamped or indelibly marked with the makers mark or name.

E. All electrical equipment shall bear the manufacturer's name and address and shall indicate its electrical capacity and characteristics.

F. All electrical materials, equipment and appliances shall conform to the latest standards of the National Electric Manufacturers Association (NEMA) and the National Board of Fire Underwriters (NBFU) and shall be approved by the Owner's insuring agency if so required.

19. QUALIFICATIONS OF WORKMEN

A. All electrical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen as evidenced by their workmanship shall be relieved of their responsibilities in those areas. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workmen shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of responsibility established by the Architect or the contract document provisions.

B. All electrical work shall be accomplished by Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.

C. Special electrical systems, such as Fire Detection and Alarm Systems, Intercom or Sound Reinforcement Systems, Telecommunications or Data Systems, Lightning Protection Systems, Video Systems, Special Electronic Systems, Control Systems, etc., shall be installed by workmen normally engaged or employed in these respective trades. As an exception to this, where small amounts of such work are required and are, in the opinion of the Engineer, within the competency of workmen directly employed by the Contractor involved, they may be provided by this Contractor.

20. CONDUCT OF WORKMEN

A. The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workmen to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption or influence of alcoholic beverages, narcotics or illegally used controlled substances on the jobsite is strictly forbidden.

21. COOPERATION AND COORDINATION BETWEEN TRADES

A. The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Mechanical, Structural and other pertinent Drawings, to the end that complete coordination between trades will be effected.

B. Refer to Coordination Among Trades, Systems Interfacing and Connection of Equipment Furnished by Others section of these Specifications for further coordination requirements.

22. PROTECTION OF EQUIPMENT

A. The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by

a means acceptable to the Engineer. All rough-in conduit shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged while stored on site either before or after installation shall be repaired or replaced (as determined by the Engineer) by the responsible Contractor.

23. CONCRETE WORK

A. The Contractor shall be responsible for the provision of all concrete work required for the installation of any of his systems or equipment. If this work is provided by another trade, it will not relieve the Electrical Contractor of his responsibilities relative to dimensions, quality of workmanship, locations, etc. In the absence of other concrete specifications, all concrete related to Electrical work shall be 3000 PSI minimum compression strength at 28 days curing and shall conform to the standards of the American Concrete Institute Publication ACI-318. Heavy equipment shall not be set on pads for at least seven days after pour.

B. All concrete pads shall be complete with all pipe sleeves, embeds, anchor bolts, reinforcing steel, concrete, etc., as required. Pads larger than l8" in width shall be reinforced with minimum #4 round bars on 6" centers both ways. All reinforcing steel shall be per ASTM requirements, tied properly, lapped 18 bar diameters and supported appropriately up off form, slab or underlayment. Bars shall be approximately 3" above the bottom of the pad with a minimum 2" cover. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms properly adhered repairs shall be made. If structural integrity is violated, the concrete shall be replaced. All surfaces shall be rubbed to a smooth finish.

Special Note: All pads and concrete lighting standard bases shall be crowned slightly so as to avoid water ponding beneath equipment.

C. In general, concrete pads for small equipment shall extend 6" beyond the equipment's base dimensions. For large equipment with service access panels, extend pads l8" beyond base or overall dimensions to allow walking and servicing space at locations requiring service access.

D. Exterior concrete pads shall be 4" minimum above grade and 4" below grade on a tamped 4" dense grade rock base unless otherwise noted or required by utility company. Surfaces of all foundations and bases shall have a smooth finish with three-quarter inch radius or chamfer on exposed edges, troweled or rubbed smooth. All exterior pads shall be crowned approximately 1/8" per foot, sloping from center for drainage.

24. RESTORATION OF NEW OR EXISTING SHRUBS, PAVING, ETC.

A. The Contractor shall restore to their original condition all paving, curbing surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and

shall match materials employed in the original construction of the item to be replaced. All repairs shall be to the satisfaction of the Engineer, and in accord with the Architect's standards for such work, as applicable.

25. MAINTENANCE OF EXISTING UTILITIES AND LINES

A. The locations of all piping, conduits, cables, utilities and manholes existing, or otherwise, that come within the contract construction site, shall be subject to continuous uninterrupted maintenance with no exception unless the Owner of the utilities grants permission to interrupt same temporarily, if need be. Provide one week's written notice to Engineer, Architect and Owner prior to interrupting any utility service or line. Also see Article 1. - General, this section.

B. Known utilities and lines as available to the Engineer are shown on the drawings. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain that no utilities or lines, known or unknown, are endangered by the excavation.

C. If the above-mentioned utilities or lines occur in the earth within the construction site, the Contractor shall first probe and make every effort to locate the lines prior to excavating in the respective area.

D. Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.

E. The Contractor shall repair to the satisfaction of the Engineer any surface or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

F. Machine excavation shall not be permitted within ten feet of existing gas or fuel lines. Hand excavate only in these areas, in accord with utility company, agency or other applicable laws, standards or regulations.

G. Protect all new or existing lines from damage by traffic, etc. during construction.

H. Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

26. SMOKE AND FIRE PROOFING

A. The Contractor shall not penetrate rated fire walls, ceilings or floors with conduit, cable, bus duct, wireway or other raceway system unless all penetrations are protected in a code compliant manner which maintains the rating of the assembly. Smoke and fire

stop all openings made in walls, chases, ceiling and floors. Patch all openings around conduit, wireway, bus duct, etc., with appropriate type material to smoke stop walls and provide needed fire rating at fire walls, ceilings and floors. Smoke and fire proofing materials and method of application shall be approved by the local authority having jurisdiction.

27. QUIET OPERATION, SUPPORTS, VIBRATION AND OSCILLATION

A. All work shall operate under all conditions of load without any objectionable sound or vibration, the performance of which shall be determined by the Engineer. Noise from moving machinery or vibration noticeable outside of room in which it is installed, or annoyingly noticeable noise or vibration inside such room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor (or Contractors responsible) at his expense.

B. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc., by means of flexible connectors, vibration absorbers or other approved means. Surface mounted equipment such as panels, switches, etc., shall be affixed tightly to their mounting surface.

C. The Contractor shall provide supports for all equipment furnished by him using an approved vibration isolating type as needed. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. No work shall depend on the supports or work of unrelated trades unless specifically authorized in writing by the Architect or Engineer.

28. FINAL CONNECTIONS TO EQUIPMENT

A. The roughing-in and final connections to all electrically operated equipment furnished under this and all other sections of the contract documents or by others, shall be included in the Contract and shall consist of furnishing all labor and materials for connection. The Contractor shall carefully coordinate with equipment suppliers, manufacturers representatives, the vendor or other trades to provide complete electrical and dimensional interface to all such equipment (kitchen, hoods, mechanical equipment, panels, refrigeration equipment, etc.).

29. WELDING

A. The Contractor shall be responsible for quality of welding done by his organization and shall repair or replace any work not done in accordance with the Architect's or structural Engineer's specifications for such work. If required by the Engineer, the responsible Contractor shall cut at least three welds during the job for X-raying and testing. These

welds are to be selected at random and shall be tested as a part of the responsible Contractor's work. Certification of these tests and X-rays shall be submitted, in triplicate, to the Engineer. In case a faulty weld is discovered, the Contractor shall be required to furnish additional tests and corrective measures until satisfactory results are obtained.

30. ACCESSIBILITY

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in partitions and above suspended ceilings for the proper installation of his work. He shall cooperate with the General Contractor (or Construction Manager) and all other Contractors whose work is in the same space, and shall advise each Contractor of his requirements. Such spaces and clearances shall be kept to the minimum size required to ensure adequate clearance and access.

B. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to junction boxes, pull boxes, contactors, panels, disconnects, controllers, switchgear, etc. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved where the equipment is concealed.

C. Each Contractor shall provide (or arrange for the provision by other trades) the access panels for each concealed junction box, pull box, fixtures or electrical device requiring access or service as shown on Engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. All access panels shall be installed in accord with the Architect's standards for such work.

D. Access Doors; in Ceilings or Walls:

(1) In mechanical, electrical, or service spaces:

14-gauge aluminum brushed satin finish, 1" border.

(2) In finished areas:

14-gauge primed steel with 1" border to accept the architectural finishes specified for the space. Confirm these provisions with the Architect prior to obtaining materials or installing any such work.

(3) In fire or smoke rated partitions, access doors shall be provided that equal or exceed the required rating of the construction they are mounted in.

31. ELECTRICAL CONNECTIONS

A. The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. The Contractor shall install all starters not factory mounted on equipment. Unless otherwise

noted, the supplier of equipment shall furnish starters with the equipment. Also refer to Divisions 11, 14, 20, 21, 22, 23 and 25 of the Specifications, shop drawings and equipment schedules for additional information.

B. All control, interlock, sensor, thermocouple and other wiring required for equipment operation shall be provided by the Contractor. All such installations shall be fully compliant with all requirements of Division 26 and 27 regardless of which trade actually installs such wiring. Motors and equipment shall be provided for current and voltage characteristics as indicated or required. All wiring shall be enclosed in raceways unless otherwise noted.

C. Each Contractor or sub-contractor, prior to bidding the work, shall coordinate power, control, sensor, interlock and all other wiring requirements for equipment or motors with all other contractors or sub-contractors, to ensure all needed wiring is provided in the Contract. Failure to make such coordination shall not be justification for claims of extra cost or a time extension to the Contract.

32. MOTORS

A. Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box and N.E.C. required disconnecting means as indicated or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.

B. The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower as applicable. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. See Division 20, 22 and 23 of the Specifications for further requirements and scheduled sizes.

C. All three-phase motors shall be tested for proper rotation. Correct wiring if needed and retest. Document testing and corrective action in operations and maintenance manual.

33. CUTTING AND PATCHING

A. Unless otherwise indicated or specified, the Contractor shall provide cutting and patching necessary to install the work specified in this Division. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accord with the Architect's standards for such work, as applicable.

B. No structural members shall be cut without the approval of the Structural Engineer and all such cutting shall be done in a manner directed by him.

C. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore, all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

34. ANCHORS

A. Each Contractor shall provide and locate all inserts required for his work before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.

35. WEATHERPROOFING

A. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

B. Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

36. OPERATING INSTRUCTIONS

A. Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating his systems and equipment for a period of three days of eight hours each, or as otherwise specified. During this period, instruct the Owner or his representative fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least one week's written notice to the Owner, Architect and Engineer in advance of this period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representative that were present.

B. Each Contractor shall furnish three complete bound sets for approval to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.

C. Each Contractor, in the above-mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

D. Formatting & content shall follow the guidelines outlined in the latest version of ASHRAE Applications Handbook, Guideline 4. As a minimum, the following shall be included:

- The operation and maintenance document directory should provide easy access and be well organized and clearly identified.
- Emergency information should be immediately available during emergencies and should include emergency and staff and/or agency notification procedures.
- The operating manual should contain the following information:

  I. General Information
     a. Building function
     b. Building description
     c. Operating standards and logs

  II. Technical Information
     a. System description
     b. Operating routines and procedures
     c. Seasonal start-up and shutdown
     d. Special procedures
     e. Basic troubleshooting

- The maintenance manual should contain the following information:

  I. Equipment data sheets
     a. Operating and nameplate data
     b. Warranty

  II. Maintenance program information
     a. Manufacturer's installation, operation, and maintenance instructions
     b. Spare parts information
     c. Preventive maintenance actions
     d. Schedule of actions
     e. Action description
     f. History

- Test reports document observed performance during start-up and commissioning.

37. SCAFFOLDING, RIGGING AND HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

38. CLEANING

A. The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish caused by his operations; and at the completion of the work, shall remove all rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.

B. After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

39. PAINTING

A. Each fixture device, panel, junction box, etc., that is located in a finished area shall be provided with finish of color and type as selected or approved by the Architect or Engineer. If custom color is required, it shall be provided at no additional cost to the Owner. All other equipment, fixtures or devices located in finished or unfinished areas, that are not required to have or are provided with finish color or coating shall be provided in a prime painted condition, ready to receive finish paint or coating. All galvanized metal in finished areas shall be properly prepared with special processes to receive finish paint as directed and approved by the Architect.

40. INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

41. HAZARDOUS MATERIALS

A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, ensure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.

D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

42. ABOVE-CEILING AND FINAL PUNCH LISTS

A. The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project:

(1) For review of above-ceiling work that will be concealed by tile or other materials well before substantial completion.

(2) For review of all other work as the project nears substantial completion.

B. When <u>all</u> work from the Contractor's punch list is complete at each of these stages and <u>prior</u> to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on <u>each</u> item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to

the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.

C. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of $125.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.



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The following is CMTA's guide for required electrical information relative to the Schedule of Values. Please utilize all items that pertain to this project and add any specialized system as required. A thorough and detailed schedule of values will allow for fair and equitable Pay Application approval and minimize any discrepancies as to the status of the job.

Electrical

Description of Work	Scheduled Value	Labor	Material
Shop Drawings			
Mobilization/Permits			
Temporary Utilities			
Demolition			
Site Utilities			
Switchgear			
Branch Panels			
Feeder Conduit			
Branch Conduit			
Feeder Wire			
Branch Wiring			
Emergency Generator			
Fire Alarm Conduit & Wiring			
Fire Alarm Devices			
Cabletray & Accessories			
Light Fixture Interior			

Light Fixture Exterior			
Lighting Control System			
Wiring Devices			
Surge Suppression			
Chemical Grounding System			
Intercom/Paging Conduit			
Intercom/Paging Wiring			
Intercom/Paging Devices			
CCTV System Conduit			
CCTV System Wiring			
CCTV System Devices			
Intrusion Detection Conduit			
Intrusion Detection Wiring			
Intrusion Detection Controller & Devices			
Voice/Data System Conduit			
Voice/Data System Wiring			
Voice/Data System Devices & Termination			
Audio/Video System Conduit			
Audio/Video System Wiring			
Audio/Video System Devices & Termination			
Electrical Inspection			
Owner Training			
Record Drawings			
O & M Manuals			
Punch List / Closeout			

END OF SECTION 26 05 01

SECTION 26 05 02 - SCOPE OF THE ELECTRICAL WORK

1. GENERAL

   Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

2. SCOPE OF THE ELECTRICAL WORK

   The Electrical work for this project includes all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, verify place in service and deliver to the Owner complete electrical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not limited to the following:

   A. All conduits, raceways, conductors, outlet boxes, fittings, hangers, etc.

   B. All switchgear, panels, disconnect switches, fuses, transformers, contactors, starters, etc.

   C. Electrical equipment pads, equipment mounting racks/structures, etc.

   D. All electrical grounding systems.

   E. Integral/remote surge suppression devices, and associated infrastructure.

   F. Natural gas emergency generator system, automatic transfer switches, emergency generator docking stations, and all required emergency electrical system components.

   G. All site utility raceways and conductors required for separate building services (electrical & telecomm.), including all required excavation and coordination with other trades on site.

   H. All site utility pullboxes and in-grade boxes.

   I. Fault Current, Arc Flash and Breaker Coordination Study for all new electrical panels and distribution equipment, where applicable.

   J. Required testing of primary/secondary electrical conductors, telecommunications cabling, etc. in accordance with all owner testing requirements, and as noted in the project specifications.

   K. All wiring devices and device plates, including floorboxes, wallboxes and cast-in place devices.

   L. LED lighting fixtures and lamps, lighting control systems, etc.

   M. Electrical connection to all electrically operated equipment furnished and/or installed by others, including powered casework, mechanical equipment, specialty lighting fixtures/controls, etc.

N. Electronic access control and electronic security system.

O. Voice/Data wiring system, data racks and infrastructure, and owner furnished equipment/devices.

P. CATV wiring and distribution system, where applicable.

Q. Demolition of the existing building electrical systems as noted, upon the complete construction of the new school building.

R. New Addressable Fire alarm & detection system, including all necessary hardware, devices, interconnecting systems, etc.

S. All duct smoke detectors, remote testing stations, interconnection wiring, testing, etc.

T. All elevator communication and code/AHJ required first responder systems, as required by the AHJ and local codes.

U. Recertification of existing equipment and infrastructure, where applicable and required by code.

V. Patch and repair of all new and existing device locations, penetrations, etc. that fall under the contractors scope of work in the project area, where applicable.

W. Commissioning of electrical systems, where applicable.

X. Demolition and reconnection of existing site utility systems and equipment, where applicable.

Y. All necessary coordination with Owner's physical plant, engineering, information technology departments, etc. to insure that work, connections, etc., that they are to provide is accomplished and that service to this facility is delivered complete prior to occupancy.

Z. Paying all necessary fees and cost for permits, inspections, work by utility companies (power, telephone, CATV, etc). The Contractor shall contact the utility companies prior to submitting a bid to determine exactly these charges will be.

AA. Prior to submitting a bid, the Contractor shall contact all serving utility companies to determine exactly what each utility company will provide and exactly what is required of the Contractor and the Contractor shall include all such requirements in his base bid.

BB. Obtaining, coordinating and paying all necessary fees and costs for permits and inspections required by local, state and federal law. The Contractor shall contact the appropriate agencies prior to submitting a bid to determine exactly these charges will be.

END OF SECTION 26 05 02

SECTION 26 05 03 - SHOP DRAWINGS, LITERATURE, MANUALS, PARTS LISTS AND SPECIAL TOOLS

1. SHOP DRAWINGS

A. Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, seven sets of shop drawings and/or manufacturer's descriptive literature on all equipment required for the fulfillment of his contract. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced so the specifications, schedules, light fixture numbers, panel names and numbers, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified by hand shall be noted in color red on the submittals. The Contractor shall make any corrections or changes required and shall resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals. The term "as specified" will not be accepted.

B. If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.

C. Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

D. The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.

E. No cutting, fitting, rough-in, connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain reviewed shop drawings and to make all

connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.

F. All equipment furnished as part of this project shall be specified with a minimum of two (2) years parts and labor warranty from the applicable equipment manufacturer, per owner standards. Refer to individual specification sections for warranties of increased length and/or additional stipulation. Warranties for equipment shall be specified from the time of substantial completion of the project.

G. In accord with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:

Power Equipment

- Fault current and arc flash coordination study (submit along with switchgear & panelboards.
- Circuit breakers and/or fusible switches, per each type.
- Disconnect switches.
- Outlet boxes and fittings, per each type required.
- Fuses, per each type required.
- Control components (relays, timers, selector switches, pilots, etc.
- Transient voltage surge suppression system, per each type required.
- Grounding system, including ground rods and grounding busbars.

Raceways

- Wireways and each type of wireway fitting.
- Surface-mounted metal or plastic raceways, with each type of fitting.
- J-hook or Bridle ring assemblies.

Devices

- Each type of wiring device and their cover plates.
- Floor boxes, each by type, with the required accessories.
- Data/voice/video wall plates, each by type.
- Any special items not listed above.

Systems

Note: Each system submittal is to be complete with legible cutsheets for all devices, equipment, special wiring, etc. Include system specific wiring schematics showing each

device and its specific interconnect/wiring requirements. For rack mounted equipment, provide a scalable elevation drawing with proposed component locations & specific interconnect wiring requirements for each component/panel. Also provide scale building specific layout drawings that indicate device placement, wiring, etc. Refer to the specific system's specification for additional submittal requirements where required.

- Fire alarm system.
- Intrusion detection system.
- Building paging/intercom audio system.
- Telephone system.
- Video system.
- Data network.
- Intercom/door release system.

Miscellaneous

- Control panel assemblies.
- Non-standard junction/pullboxes.
- Manholes, hand holes, and all outdoor electrical equipment and fittings.

2. SPECIAL WRENCHES, TOOLS AND KEYS

A. Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, emergency generators, alarm pull boxes and panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

3. FIRE ALARM SHOP DRAWINGS

A. The Contractor and equipment supplier shall submit to the Architect and/or Engineer, fire alarm system shop drawings complete with catalog cuts, descriptive literature and complete system wiring diagrams for their review prior to the Contractor’s submittal to the Commonwealth's Department of Housing, Buildings and Construction or other governing authority for their review. No work shall be done until drawings are approved by the Kentucky Department of Housing, Buildings and Construction.

4. MAINTENANCE AND OPERATION MANUALS

A. Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three complete copies of operation and maintenance instructions and parts lists for all equipment provided.

Formatting and content shall follow the guidelines outlined in the latest version of ASHRAE Application Handbook, Guideline 4. As a minimum, the following shall be included:

- The operation and maintenance document directory should provide easy access and be well organized and clearly identified.
- Emergency information should be immediately available during emergencies and should include emergency and staff and/or agency notification procedures.
- The operating manual should contain the following information:

  I. General Information
     a. Building function
     b. Building description
     c. Operating standards and logs

  II. Technical Information
     a. System description
     b. Operating routines and procedures
     c. Seasonal start-up and shutdown
     d. Special procedures
     e. Basic troubleshooting

- The maintenance manual should contain the following information:

  I. Equipment data sheets
     a. Operating and nameplate data
     b. Warranty

  II. Maintenance program information
     a. Manufacturer’s installation, operation, and maintenance instructions
     b. Spare parts information
     c. Preventive maintenance actions
     d. Schedule of actions
     e. Action description
     f. History

- Test reports documents observed performance during start-up and commissioning.

END OF SECTION 26 05 03

SECTION 26 05 04 - SLEEVING, CUTTING, PATCHING AND REPAIRING

1. GENERAL

A. The Contractor shall be responsible for all openings, sleeves, trenches, etc. that he may require in floors, roofs, ceilings, walls, etc. and shall coordinate all such work with the General Contractor and all other trades. He shall determine and coordinate any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the responsible Contractor.

B. The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for conduit, buss duct, conductors, wireways, etc. to go through; however, when this is not done, this Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Architect. Any damage caused to the building by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.

C. The Contractor shall cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.

D. The Contractor shall notify other trades in due time where he will require openings of chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.

E. Openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

F. Cast iron sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking with lead and oakum between pipe and sleeve for waterproofing.

G. In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter.

H. Sleeves passing through roof or exterior wall or where there is a possibility of water leakage and damage shall be caulked water tight for horizontal sleeves and flashed and counter-flashed with lead (4 lb.) or copper and soldered to the piping, lapped over sleeve and properly weather sealed. Any roof penetration shall not void or lessen the warranty in any way.

I. All rectangular or special shaped openings in plaster, stucco or similar materials including gypsum board shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirements is to provide smooth even

termination of wall, floor and ceiling finishes as well as to provide a fastening means for lighting fixtures, panels, etc. Lintels shall be provided where indicated over all openings in bearing walls, etc.

J. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Architect.

K. The Contractor shall be responsible for properly shoring, bracing, supporting, etc. any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Architect.

L. All work improperly done or not done at all as required by the Contractor will be performed by others. The cost of this work shall be paid for by the Contractor who is in non-compliance with the Contract.

2. SLEEVES, PLATES AND ESCUTCHEONS

A. The Contractor shall provide and locate all sleeves required for his work before the floors and surface being penetrated are built, otherwise the Contractor shall core drill for conduits where sleeves were not installed, or where incorrectly located. Core drilling is the only acceptable alternative to sleeves. Do not chisel openings. Where sleeves are placed in exterior walls or in slabs on grade, the space between the conduit and the sleeves shall be made completely and permanently watertight.

B. Conduits that penetrate fire and/or smoke rated assemblies shall have sleeves installed as required by the manufacturer of the rating seal used.

C. At all other locations either pipe sleeves or core drilled openings are acceptable.

D. Where thermal expansion does not occur, the wall may be sealed tight to the conduit.

E. Sleeves shall be constructed of 24-gauge galvanized sheet steel with lock seam joints or Schedule 40 pipe. Sleeves in floors shall extend 1" above finished floor level.

F. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction.

G. In all areas where ducts are exposed and ducts pass thru floors, the opening shall be surrounded by a 4-inch high by 3-inch-wide concrete curb.

H. Escutcheon plates shall be provided for all conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit.

Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the sleeves.

I. When installing conduit, pipe, or any other work in insulated concrete form (ICF) walls, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. Furthermore, all new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

END OF SECTION 26 05 04

SECTION 26 05 05 - DEMOLITION, RESTORATION AND SALVAGE

1. GENERAL

   A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and all other divisions of these specifications apply to work specified in this section.

2. DESCRIPTION OF WORK

   A. This section covers all demolition, restoration and salvage required to perform the electrical work indicated on the drawings, specified and/or as required to complete the project. It is the intent of this section of work to remove all existing electrical equipment, materials, etc. which are not required for the completed building and to restore any and all finished surfaces to their original type and conditions. To accomplish these requirements, the Contractor(s) shall, at his own expense, engage the services of others already performing finish work on this project. All work shall be completed to the satisfaction of the Architect/Engineers whose decisions shall be final. This requirement shall apply to all restoration work whether indicated or specified.

   B. The Contractor shall lawfully dispose of any removed P.C.B.-bearing ballasts (containing polychlorinated biphenyl), and all mercury-vapor bearing lamps, in accordance with all state, local, federal and other applicable laws and regulations.

3. ELECTRICAL

   A. Where electrical fixtures, equipment or other materials are removed and/or relocated, all abandoned conduit and conductors shall be removed in exposed areas. In concealed areas, materials shall be abandoned in place or removed as indicated and patch all openings. Cap all raceways and wiring at either end of inaccessible locations, as required by code.

   B. The Contractor shall be responsible for the removal and/or relocation of any electrical equipment, fixtures, devices, appurtenances, etc., which may, in the course of construction, interfere with the installation of any new and/or relocated Architectural, Mechanical, Electrical, Structural or Fire Protection Systems whether indicated or not.

   C. All unused/abandoned cabling discovered above accessible ceilings in the contract area of work shall be removed or properly labeled/supported for future use in accordance with nec article 760 & article 800 requirements. Coordinate final requirements with the AHJ prior to start of construction.

4. REPAIR

A. Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing of all holes, etc. in the ceiling, wall and floors where electrical equipment is removed.

5. SALVAGE

A. It is the intent of this section to deliver to the Owner all components of any electrical system which may be economically reused by him. The owner shall retain first right of refusal for all removed electrical devices in contracted scope of work. The Contractor shall make every effort to remove reusable components without damage and deliver them to a location designated by the Owner. Coordinate final salvage requirements, including delivery of salvaged devices, systems and infrastructure with the owner.

END OF SECTION 26 05 05

SECTION 26 05 06 – LIGHTNING PROTECTION SYSTEM

1. GENERAL

   A. Each Electrical Contractor's attention is directed to Section 260000, General Provisions - Electrical and all other contract documents as they may apply to his work.

2. SCOPE OF THE WORK

   A. The Electrical Contractor shall provide the necessary labor, materials, and services necessary to provide the complete lightning protection system as specified herein. This work shall include, but is not necessarily limited to:

      Conductors
      Air Terminals
      Connectors
      Splicers
      Ground Rods
      Rod Clamps
      Ground Plates
      Bonding Plates
      Surge Arrestors

3. QUALITY ASSURANCE

   A. Manufacturers: First regularly engaged in manufacturer of lightning protection equipment, of types, sizes and ratings required, whose products have been satisfactorily used in similar service for not less than 5 years. The firm shall be a member of and certified by the Lighting Protection Institute of America.

   B. Installer: A firm with at least 3 years of success installation experience on projects with lightning protection work similar to that required for project.

   C. ANSI/NFPA Compliance: Comply with NEC and NFPA No. 780, "Standard for the Installation of Lightning Protection Systems", as applicable to materials and installation of lightning protection components and wiring.

   D. ANSI Compliance: Comply with applicable portions of ANSI C2 and C62.2 pertaining to lightning (surge) arrestors.

   E. UL Compliance: Comply with UL 96, "The Standard for Lightning Protection Components" and UL96A, “Installation Requirements for Lightning Protection Systems” pertaining to design, materials and sizing of lightning protection components. Provide components which are UL listed and labeled.

4. SUBMITTALS

A. Product Data: Submit manufacturer's data on lightning protection systems and components.

B. Shop Drawings: Submit dimensioned layout drawings of lightning protection system equipment and components including conductor routing and connections.

C. Maintenance Data: Submit maintenance instructions for lightning protection system. Include this data in maintenance manuals.

D. UL Certificate: Provide Owner with UL Master "C" Label for new buildings overall system which is suitable for fastening to building for display. Comply with UL 96A. "Master Labeled Lightning Protection Systems".

5. MATERIALS

A. Acceptable Manufacturers

Available Manufacturers: Subject to compliance with requirements, manufacturers offering lightning protection components which may be incorporated in the work include, but are not limited to, the following:

Conductors and Air Terminals:

Independent Protection Co., Inc.
Thompson Lightning Protection, Inc.
A/C Lightning Protection Co., Inc.

Protective Devices (Surge Arrestors):

General Electric Co.
TII Industries, Inc.
Atlantic Scientific Corp.

6. LIGHTNING PROTECTION SYSTEM COMPONENTS

A. General

(1) Provide lightning protection system components of types, sizes, ratings for class of service indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information and as required for a complete installation. Where more than one type of component meets requirements, selection is Installer's option. Where type or material is not otherwise indicated comply with NFPA 780 and UL 96 standards.

B. Conductors

Class 1 Installations:

(1) Main Conductors: Aluminum cable; strand dia. 0.064"; 0.095#/ft.; 98,600 circular mils.

(2) Secondary Conductors: Aluminum cable; strand dia. 0.064"; 10 strands.

(3) Air Terminals: Aluminum for concealed installation; 10" point, 1/2" x 12" long solid aluminum stem, lead washer, support bracket and adjustable clamp type cable connector.

(4) Connector: Aluminum right-angle thru-roof cable connector; bronze and lead seal flashing washer, 1/2" x 8" threaded stem, to fit 6" roof thickness.

(5) Connector: 4" aluminum parallel bonding clamp for connecting 1/0 or 2/0 cables.

(6) Splicer: Aluminum straight cable splicer for splicing No. 4 and No. 6 cables.

(7) Splicer: Aluminum pressure type "T" cable splicer for clamping standard cables through 2/0 with hex bolts and washers.

(8) Splicer: Bimetal straight splicer of cast aluminum and bronze for 2/0 cable with moisture tight sealing capability.

(9) Ground Rod: Solid copper, 5/8" dia. x 10'.

(10) Rod Clamp: 4" bronze ground rod clamp for connecting cable, up to and including 2/0 and 5/8" or 3/4" ground rod.

(11) Ground Plate: Sheet copper plate, 36" x 36" x 20-gauge, with 2 cable attachments.

(12) Bonding Plate: 8 sq. in. steel plate with 1" dia. bolt-hole for bonding cable to structural steel, with vice-grip type cable connector with 2" of cable contact.

(13) Surge Arrestor: Electrical service arrestor, solid state, 277/480V/3Ø/4W for exterior mounting.

7. EXECUTION - Installation of Lightning Protection Systems

A. Install lightning protection systems as indicated in accordance with equipment manufacturer's written instructions, in compliance with applicable requirements of NFPA No. 70 and 780 and with UL's lightning protection standards to ensure that lightning protection systems comply with requirements.

B. Coordinate with other work, including electrical wiring and roofing work as necessary to interface installation of lightning protection system with other work.

C. Install conductors with direct paths from air terminals to ground connections avoiding sharp bends and narrow loops.

D. Install arrestors as close as practical to equipment they are protecting. Install appropriate unit at main electrical service entrance equipment.

8. TESTING

A. Upon completion of installation of lightning protection system, test resistance-to-ground with resistance tester. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms, or less, by driving additional ground rods. Provide to the Owner and the Engineer a certificate of compliance upon completion of testing.

END OF SECTION 26 05 06

SECTION 26 05 08 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

1. COORDINATION

   A. The Contractor is expressly directed to read the General Conditions and all sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Plumbing, Fire Protection, Mechanical and Structural drawings, to the end that complete coordination between trades will be affected. Each Contractor shall make known to all other contractors the intended positioning of materials, raceways, supports, equipment and the intended order of his work. Coordinate all work with other trades and proceed with the installation in a manner that will not create delays for other trades or affect the Owner's operations.

   B. Special attention to coordination shall be given to points where raceways, fixtures, etc., must cross other ducts or conduit, where lighting fixtures must be recessed in ceilings, and where fixtures, conduit and devices must recess into walls, soffits, columns, etc. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation or time will be allowed to cover the cost of removing fixtures, devices, conduit, ducts, etc. or equipment found encroaching on space required by others.

   C. The Contractor shall be responsible for coordination with all trades to ensure that they have made provision for connections, operational switches, disconnect switches, fused disconnects, etc., for electrically operated equipment provided under this or any other division of the specifications, or as called for on the drawings. Any connection, circuiting, disconnects, fuses, etc., that are required for equipment operation shall be provided as a part of this contract.

   D. If any discrepancies occur between accompanying drawings and these specifications and drawings and specifications covering other trade's work, each trade shall report such discrepancies to the Architect far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of fixtures, devices, conduit, and equipment not installed or connected in accordance with the above instructions.

   E. In all areas where air diffusers, devices, lighting fixtures and other ceiling-mounted devices are to be installed, the Mechanical Trade(s) and the Electrical Trade and the General Trades shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangement that is acceptable to the Architect and Engineer. Where applicable, refer to reflected ceiling plans. Request layouts from the Architect or Engineer where in doubt about the potential acceptability of an installation.

2. INTERFACING

Each Electrical Trade, Specialty Controls Trade, Mechanical Trade and the General Trades, etc., shall insure that coordination is affected relative to interfacing of all systems. Some typical interface points are (but not necessarily all):

A. Connection of all controls to equipment.

B. Electrical power connections to electrically operated (or controlled) equipment.

C. Electrical provisions for all equipment provided by other trades or suppliers within this contract.

3. CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

A. Each Contractor shall make all connections to equipment furnished by others, whenever such equipment is shown on any part of the drawings or mentioned in any part of the Specifications, unless otherwise specifically specified hereinafter.

B. All drawings are complementary, one trade of the other. It is the Contractor's responsibility to examine all drawings and specifications to determine the full scope of his work. The project Engineers have arranged the specifications and drawings in their given order solely as a convenience in organizing the project, and in no way shall they imply the assignment of work to specific trades, contractors, subcontractors or suppliers.

C. Supervision to assure proper installation, functioning and operation shall be provided by the Contractor furnishing the equipment or apparatus to be connected.

D. Items indicated on the drawings as rough-in only (RIO) will be connected by the equipment supplier or Owner, as indicated. The Contractor shall be responsible for rough-in provisions only as indicated. These rough-ins shall be in accord with the manufacturer's or supplier's requirements.

E. For items furnished by others, relocated, or RIO, the Contractor shall obtain from the supplier or shall field determine as appropriate, the exact rough-in locations and connection sizes for the referenced equipment.

F. The Contractor shall be responsible for coordinating with the General and all other trades, as necessary, to determine any and all final connections that he is to make to equipment furnished by others.

END OF SECTION 26 05 08

SECTION 26 05 19 - CONDUCTORS, IDENTIFICATION, SPLICING DEVICES AND CONNECTORS

1. GENERAL

   A. This section of the Specifications covers all of the electrical power, lighting, and control power (line voltage) conductors, but does not include communications, data or signal system conductors, which are specified separately in these specifications.

   B. All conduits installed without conductors shall have a 200 lb. test nylon string installed for future use, tied off securely at each end.

   C. **No more than 40% conduit fill is permitted for <u>any</u> conduit system, including video, intercom, data, power or other signal circuits unless specifically indicated otherwise on the plans.**

   D. Lighting circuits: No more than five conductors shall be installed in conduit except for switch legs and travelers in multi-point switching arrangements.

   E. Receptacle circuits: If multiple circuits are pulled in a single homerun, a dedicated neutral shall be provided for each phase conductor. In these cases, a maximum of seven conductors are permitted in a single conduit. Conductors shall be derated per N.E.C.

   F. Intentional or unintentional painting of exposed low voltage or line voltage cabling is prohibited. The contractor shall ensure that exposed cabling is adequately protected from direct painting or overspray whether painting is required within the electrical specifications or required by other disciplines/trades. The contractor shall review the painting requirements for all disciplines and shall provide cabling protection as required. Where exposed cabling is being installed in exposed ceiling or wall spaces that are required to be painted, the contractor shall provide alternate options for cable colors and shall provide submittals for such cabling to the Engineer for approval.

      Where painted cabling as noted above is encountered during the course of construction, all cabling and connectors for painted portions of cabling shall be completely removed back to source, and reinstalled as new, and the applicable contractor's expense. Cleaning of paint or similar debris from low-voltage systems and communications cabling shall not be acceptable, and warranties on painted low-voltage cabling shall not be maintained by the manufacturer.

2. MATERIALS

   A. CONDUCTORS

      (1) All conductors shall be 98% conductive annealed copper unless otherwise noted, UL listed and labeled.

(2) Lighting and receptacle branch circuits shall be not less than No. 12 copper wire or of the sizes shown on the drawings with Type THW, THHN or THWN insulation. All feeder circuits shall be Type THW or THWN of the size as shown on the Contract Drawings. THHN wiring shall only be installed in overhead, dry or damp locations. THWN or THW wiring shall be used for all circuits pulled in underground or other wet locations.

(3) Conductors No. 10 and smaller sizes of wire shall be solid. Conductors No. 8 and larger sizes shall be stranded.

(4) Conductors for fire alarm wiring shall be stranded and in full compliance with N.E.C. 760. All fire alarm conductors shall be installed per NEC requirements, and in accordance with local codes.

(5) All wire on the project shall be new, in good condition, and shall be delivered in standard coils or reels.

(6) The color of the wire shall be selected to conform with Section 210-5 of the latest edition of the National Electrical Code. See Section #3 below, and refer also to 260519-4, Color Coding.

(7) All equipment grounding conductors shall have green color insulation or if larger than #8, shall be taped for two inches, green color at every termination and pullbox access point.

(8) Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible.

(9) Conductors for main ground from neutral bus, equipment grounding bus, building steel, grounding grid and main cold water pipe connection shall be bare copper.

(10) All conductors shall be identified by color code and by means of labels placed on conductors in all junction boxes and at each terminal point with Brady, Ideal, T & B or approved equivalent labels indicating source, circuit No. or terminal No.

(11) Branch wiring and feeder conductors that are greater than 100' in length shall be increased at least one size to compensate for voltage drop. Grounding conductor size for branch circuits shall be increased proportionally per code requirements with phase conductors to achieve the proper voltage drop for electrical systems. All circuits shall be installed and sized for a maximum 2% voltage drop. As calculated using 80% of the supply breaker rating as the load. Adjust conductors and conduit size accordingly for actual field installed conditions.

(12) Aluminum conductors shall only be permissible for feeder wiring, as indicated on the contract documents, if approved as an alternate by the engineer and the owner. All

branch circuit wiring shall be provided as copper per specifications. Refer to the electrical riser diagram and contract documents for scope of aluminum feeder wiring.

(13) Metal Clad Cable, Type MC
   a. Comply with UL1569.
   b. Circuits: Single circuit with color coded current carrying conductors and insulated ground conductor.
   c. Conductor Insulation: THHN/THWN-2.
   d. Armor Jacket: Aluminum or Steel Interlocking.
   e. Listed for use in through penetration firestop systems.
   f. Where applicable, integral 16AWG solid TFN (purple/grey) control conductors suitable for 0-10V dimming.
   g. Type HCF: rated for healthcare use with grounded green exterior sheath.
      1) HCF cable shall be provided for all branch circuits serving nurse's offices, health suites, and similar spaces in educational occupancies.

(14) MC cable is permitted for the following applications:
   a. Normal power branch circuits between wiring devices and nearest junction box, #10 and smaller, where concealed in walls and ceilings.
   b. Provide no more than three MC cable circuit connections per junction box.
   c. For power circuits, limit length of MC cable to 12ft from the junction box to the first wiring device. The final branch circuit homerun to panelboard shall be made in conduit.
   d. For lighting circuits, limit length of MC cable to 6ft from the junction box to the first luminaire and extend MC cable to other fixtures in the same room. The final branch circuit homerun to panelboard shall be made in conduit.

(15) MC cable is not permitted for the following:
   a. Emergency or standby power circuits.
   b. Feeders.
   c. Homeruns to panelboards. All panelboard homeruns shall be hard-piped in conduit per specifications.
   d. Branch circuits with conductors larger than #10 AWG.
   e. Branch circuits serving HVAC, elevator/escalator, medical and kitchen equipment loads.
   f. Within mechanical, electrical or telecommunication equipment rooms.
   g. Exposed or exterior/outdoor locations.
   h. Inaccessible ceiling locations.
   i. Within masonry walls.
   j. Wet or damp locations.
   k. Direct buried locations.

(16) Where MC cable is permitted, comply with the following:
   a. Install MC cables and connectors in accordance with NECA/NACMA 120.
   b. Use only for single-circuit applications. For devices in the same wall connected to different circuits, install separate single circuit cable for each circuit.

c. Support MC cables with clamps, clips, or similar product specifically designed for supporting cables in accordance with NEC and route all runs parallel or perpendicular to building lines with right angle turns complying with manufacturer's bend radius requirements. MC cabling shall not be left unsupported above ceiling or installed in inaccessible locations.
d. Cables shall be bundled where run in groups using listed supports to maintain proper spacing. Where spacing can't be maintained, apply adjustment factors for derating conductors.
e. Do not route through structure or on work of other trades. Provide independent supports directly from structure.
f. All MC cable which serves patient care areas, school health suite areas, or similar locations shall be type HCF, rated for healthcare use with insulated ground wire and grounded sheath. Coordinate final requirements with the engineer of record and the authorities having jurisdiction.

B. SPLICING DEVICES & CONNECTORS

(1) Splicing devices for use on No. 14 to No. 10 AWG conductors shall be pressure type such as T & B "STA-KON", Burndy, Reliable or approved equivalent.

(2) Wire nuts shall be spring pressure type, insulation 600V, 105°C insulation, up to #8 size. Greater than #6 Cu shall be a compression type connection, 600V insulation, cold shrink tubing, taped to restore full insulation value of the wire being spliced.

(3) Pressure crimp-applied ring type (or fork with upturned ends) terminations shall be employed on motor and equipment terminals where such terminals are provided on motor and equipment leads or on all stranded wire terminations using No. 10 AWG or smaller conductors.

(4) Splices, where necessary, shall be made with hydraulically-set "Hy-press" or equivalent crimped connectors. All splices shall be insulated to the full value of the wiring insulation using a cold-shrink kit or the equivalent in built-up materials.

(5) Large connectors (lugs) at terminals shall be mechanical type, hex-head socket or crimp-on style, installed per the manufacturer's recommendations.

(6) Exterior underground connections made between bare ground wires or to ground rods shall be exothermically welded, "Cadweld" or equivalent.

(7) The use of split-bolt clamps will be permitted in wireways at service entrance only. Torque to 55 foot-pounds or as recommended by manufacturer.

(8) No aluminum conductors shall be used, unless otherwise approved by the owner and the engineer of record.

(9) Provide factory-fabricated, metal connectors of sizes, ratings, materials, types and classes as indicated for each service. Where not indicated, provide proper selection

as determined by Installer to comply with installation requirements and NEC standards. All wire nuts shall be twist-on type. Non- twist-on type wire nuts shall not be allowed.

3. INSTALLATION
   A. The pulling of all wires and cable on this project shall be performed in strict compliance with applicable sections of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. Conductors shall only be installed after insulating bushings are in place.

   B. The radius of bending of conductors shall be not less than eighteen times the outside diameter of the conductor insulation or more, if recommended by the manufacturer.

   C. Conductors installed within environmental air plenums shall be per N.E.C. Article 800 and other applicable codes, with FEP-type insulation or an approved equivalent. Also provide plenum-rated tie-wraps where plastic straps or other supports, etc., are installed in plenum areas.

   D. Where indicated, communications conductors that are installed exposed shall not be routed across ceilings or ductwork. They shall be held up against building structure or against permanent support members. They shall be installed in such a manner that they do not interfere with the access to or operation of equipment or removal of ceiling tiles. Tie-wraps shall be installed in such a manner so as to bundle conductors neatly, allowing runouts of single conductors or groups to drop down to equipment served. Install grommeting where dropping out of trays or into panels or service columns. Install sleeves with bushings where penetrating partitions. Firestop sleeves with approved material. Do not penetrate firewalls if so indicated on plans. Refer to the drawings for support requirements and details on routing exposed communications conductors.

   E. Conductors for isolated power systems shall be installed in as short a run of conduit as practicable. No pulling soap shall be used on conductors in isolated power systems.

   F. Maximum permissible pulling tensions, as recommended by the manufacturer for any given type of cable or wire installed shall not be exceeded. Utilize special remote readout equipment as required to ensure compliance. Use particular caution when installing twisted pair data cable or fiber optic cables -- forces permitted for pulling in are typically very low for these cable types.

   G. All cables and wiring, regardless of voltage, installed in manholes or cable vaults shall be routed in such a manner to provide a minimum of 6 feet of slack cable for future splicing. Install cables along walls by utilizing the longer route from entry to exit. If both routes are symmetrical, provide a loop of cable secured to wall. All cables shall be tied to insulated cable supports on wall-mounted racks, spaced a maximum of three feet apart.

H. Where multiwire branch circuits are allowed, the phases and neutral shall be wire-tied together in the panelboard and in all pull boxes.

4. FIELD QUALITY CONTROL

A. Prior to energization, test cable and wire for continuity of circuitry, and also for short circuits. Correct malfunctions when detected.

B. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

5. COLOR CODING DISTRIBUTION VOLTAGE CONDUCTORS, 600 VOLT OR LESS

Conductors to be color coded as follows:

A. 120/208 Volt Conductors
   (1) Phase A - Black
   (2) Phase B - Red
   (3) Phase C - Blue
   (4) Neutral - Solid White or White with tracer stripe to match phase conductor

B. 277/480 Volt Conductors
   (1) Phase A – Brown
   (2) Phase B – Orange
   (3) Phase C – Yellow
   (4) Neutral – Solid Gray or White with tracer stripe to match phase conductor

C. Isolated Power Conductors (Type XLP or XHHN)
   (1) Phase A – Brown with colored stripe other than white, green or grey
   (2) Phase B Device or Neutral- Orange with colored stripe other than white, green or grey
   (3) Phase C - Yellow with colored stripe other than white, green or grey
   (4) Neutral on Three-Phase Systems- Solid White or White with tracer stripe to match phase conductor
   (5) Note: Further identify isolated power conductors with □" wide purple tape at all terminations and junctions.

D. Control Wiring - Red, or as indicated.

E. Conductors within enclosures that may be energized when enclosure disconnect is off - yellow, or taped with 1/2" yellow tape every 6" of length, inside enclosure. Provide lamacoid plate warning sign on front of enclosure where this condition occurs.

F. D.C. Wiring - Positive - Light Blue
   (1) Negative - Dark Blue

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING

1. GENERAL

   A. All metallic conduit, raceways, cable trays, wireways, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code, as shown on the Contract Drawings and in accord with the requirements of the local authority having jurisdiction, as applicable.

   B. The size of the equipment grounding conductors, grounding electrode conductors and service grounding conductors shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings. Where ungrounded conductor sizes are increased to minimize voltage drop, grounded conductor sizes shall be increased in the proper proportion.

   C. Grounding bus and non-current carrying metallic parts of all equipment and raceway systems shall be securely grounded by connection to common ground.

   D. The service entrance main ground bus shall also be connected to the main cold metallic water pipe within three feet of where it enters the building, on both the house and street sides of the main shut-off valve with a properly sized bonding jumper. A properly sized bonding jumper shall also be provided to the frame of any steel structure utilized in the construction. The steel frame of the building (if any) shall be made electrically continuous.

2. MATERIALS

   A. Ground wires and cables shall be of the AWG sizes shown on the Contract Drawings or shall be sized in accord with the prevailing codes. All ground wires and cables shall be copper.

   B. All grounding fittings shall be heavy cast bronze or copper of the mechanical type except for underground installations or interconnection of grounding grid to cable, columns and ground electrodes, which shall be thermically welded type as manufactured by Cadweld, Burndy Co., Therm-O-Weld, or approved equivalent. Other bonding clamps or fittings in above ground locations shall be as manufactured by O.A. Co., T & B, Burndy, or approved equivalent.

3. INSTALLATION

   A. All grounding conductors shall be protected from mechanical injury and shall be rigidly supported. Where ground conductors are run through flexible conduit and through panelboard switchboard or motor control center feeders, they shall be securely bonded to such conduit thru the use of grounding bushings at the entrance and exit. All connection of equipment shall be made with an approved type of solderless connection and same shall be bolted or clamped to equipment or conduit.

B. All equipment grounding conductors to lighting fixtures, devices, receptacles, electric heaters, furnace and other equipment not exceeding No. 8 AWG in size shall be green colored Type "THWN".

C. Equipment ground connections to GFI circuit breakers shall be carried and bonded to each outlet on the circuit. Provide a separate equipment grounding conductor with green color insulation.

D. Resistance to the grounding at the service entrance equipment shall be in accordance with the N.E.C. for style of construction and shall not exceed ten ohms as measured by the described testing method.

E. All circuits shall have a separate grounding conductor, except as otherwise noted.

F. When grounding systems are completely installed and all grading in the area of the service grounding electrode has been completed up to finish elevations, perform a fall-of potential or other approved test to determine actual system resistance to earth. Report results to the Engineer in writing. Refer to testing provisions in this section of specifications.

G. Where separately-derived systems are utilized as part of the power distribution network, the neutral leg of the secondary side of generators, transformers, etc., shall be connected to a grounding electrode in accordance with the manufacturer's recommendations.

H. The Contractor shall ensure that the ground return path thru building structural steel or other means is electrically continuous back to the service grounding electrode and is of adequate capacity and impedance to carry the maximum expected fault or other current. Where no electrically continuous steel building frame is available, the Contractor shall provide a properly sized ground bar and ground conductor routed back to the main facility ground bus.

I. Where a building's steel frame is made electrically discontinuous by masonry breaks (as at firewalls, etc.), the Contractor shall provide an accessible thermically welded bonding jumper of #500MCM copper to bond the building steel frame sections together, making the entire steel frame electrically continuous. The installation of these bonding jumpers shall be reviewed by the Engineer prior to their being covered by construction.

J. Where lightning protection systems are utilized on the work, their electrodes and conductors shall be electrically segregated from the building service ground, except where connections to structural elements are required for the proper installation of these systems. Lightning protection grounds shall only be utilized for lightning grounding applications, in accord with U.L. and manufacturer's recommendations.

K. Grounding connections shall <u>never</u> be made to fire protection, natural gas, flammable gas or liquid fuel piping, except where specifically indicated on the plans.

L. Where dielectric fittings are utilized in piping systems, the piping system shall <u>not</u> be utilized as a ground path. Bonding jumpers shall not be utilized to bridge over such fittings.

Piping systems shall not be utilized as ground paths except where specifically required by codes in the case of water piping.

4. GROUNDING ELECTRODE SYSTEM

A. The ground electrode system shall be as specified herein. The system shall not require maintenance throughout the expected life span of the materials.

B. Ground system shall be an electrolytic rod type, as manufactured by Lyncole XIT Grounding, Superior Grounding Systems, L.E.C., Inc. (Chem-Rod), or approved equivalent. Electrode(s) shall be placed as shown on the plans, installed exactly per manufacturer's recommendations. Electrodes shall be installed vertically, 12 feet of overall length (or length as indicated), set in a drilled hole and backfilled per manufacturer's instructions with a special clay slurry surrounding the rod. Provide a concrete protection box with cast iron grate for the top of the rod termination. Ground system shall be per the following:

(1) Manufacturer: Lyncole XIT Grounding (or approved equivalent).
(2) Source: Lyncole XIT Grounding, 22412 S. Normandie Ave., Torrance, CA 90502 1-800-962-2610
(3) Shaft Configuration: Straight.
(4) Shaft Length: 12 feet (or as otherwise indicated).
(5) Listings: U.L.-467J, ANSI 633.8.
(6) Material: Type K Copper.
(7) Construction: Hollow tube, 2.125" O.D., chemical filled with non-hazardous metallic salts.
(8) Weight 3.5 lbs. per foot of length, nominal.
(9) Ground Wire Termination: Exothermic ("Cadweld" by Contractor) connection to 4/0 conductor, with U-bolt with pressure plate provided as test point.
(10) Average Life Expectancy: 25 Years.
(11) Model Number: K2-(length)CS.
(12) Provide grounding system with the following components: protective box, backfill material. Box to be concrete with cast iron, tamper-resistant lid, backfill to be "Bentonite" clay.

C. Installation of Pipe Ground System

(1) **Pipe ground systems shall be installed exactly as required by the system manufacturer. The Contractor shall be diligent to observe the excavation, sealing tape removal, slurry backfill and all other critical requirements.**

(2) **Note: NEVER USE SAND OR ORDINARY EARTH AS A BACKFILL MATERIAL**

D. Pipe grounding system shall be warranted unconditionally by the Contractor for a period of two years from the date of substantial completion.

5. GROUND TESTING PROCEDURE

A. The actual resistance to earth of the service grounding electrode shall be measured by the Contractor via the fall-of-potential method. This testing shall be accomplished after the grounding electrode has been completely installed and the finished grade is achieved.

B. The results of the testing shall be summarized in a written report by the Contractor, which shall be forwarded to the Engineer for review. The report shall also be included with the operation and maintenance manuals for the Owner's information and future reference. This report is to also contain a detailed description and illustrations of the testing procedure, along with the name and model number of the testing instrument(s).

C. For the actual testing, the Contractor shall follow the procedures outlined below. A self-contained instrument such as a "Megger" or "Ground OHMMETER" shall be used that is designed to eliminate the influence of stray current effects on the accuracy of the measurements.

(1) Connect one side of the instrument to the grounding electrode conductor where it connects to the facility main ground bus (point C1). Disconnect and isolate the grounding electrode conductor for the test.

(2) Drive a copperweld reference electrode probe (point C2) into earth between 300 and 500 feet away from C1 and connect to measurement instrument.

(3) Drive the movable grounding probe (C3) into earth at ten equally spaced intervals, in a straight line between C1 and C2 points and note the E/I=R resistance readings on a graph at each point.

(4) The resistance measurements in OHMS taken from the flat part of the curve shall be averaged to determine the true grounding electrode resistance to earth.

(5) At completion of testing, remove reference electrode C2 and all temporary wiring and connections.

(6) If actual measurements of grounding electrode indicate a resistance greater than five OHMS, contact the Engineer for instructions. If deemed necessary by the Engineer, additional electrodes shall be placed and the measurement process repeated until the desired ground potential is achieved.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 26 Section "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.
d. Seasafe, Inc.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 regarding installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT & RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use the same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint with a brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 painting Section for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 31 - CABINETS, OUTLET BOXES, AND PULL BOXES

1. GENERAL

   A. This section of the specifications covers all electrical cabinets, outlet boxes and pull boxes.

   B. Continuous runs of conduit shall have properly sized pull boxes at least each eighty-five feet of run, or as near as possible to that limit.

2. MATERIALS & INSTALLATION

   A. Cabinets, Outlet and Pull Boxes:

      (1) Cabinets for lighting and power, telephone, pull boxes, outlet boxes, or any other purposes specified or shown on the Contract Drawings, shall be constructed of code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. Boxes assembled with sheet metal screws will not be accepted. Pull boxes shall include all boxes used to reduce the run of conduit to the required number of feet or bends, supports, taps, troughs, and similar applications and shall also be constructed as specified above.

      (2) All cabinets and boxes for NEMA 1 and 1A application shall be provided with knockouts, as necessary, or shall be cut in the field by approved cutting tools which will provide a clean, symmetrically cut opening. All boxes, except panelboards, shall be provided with code gauge fronts with hex head or pan head screw fasteners. Outdoor cabinets shall be hinged cover with pad locking provisions. Fronts for panelboards shall be as specified for panelboards.

      (3) Ceiling outlet boxes shall be galvanized steel, 4" octagonal, not less than 2 1/8" deep, with lugs or ears to secure covers. Those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable. Provide adequate support with at least a 2 x safety factor for the anticipated fixture weight.

      (4) Special size concealed outlet boxes for clocks, speakers, alarms, panels, etc., shall be provided by the manufacturer of the equipment.

      (5) Floor outlet boxes shall be as specified in Section 262726, fully adjustable unless noted or specified otherwise.

      (6) Unless otherwise noted on the drawings or in the specifications, outlet boxes shall be installed at the following heights to centerline of box:

      Wall Switches, Control Stations .....3'-10"
      Convenience Outlets .....1'-6"
      Convenience Outlets - Above Counters ..... Bottom at 2" above top of backsplash
      T.V. Outlets.....1'-6"

T.V. Outlets - At Wall Brackets.....7'-2"
Desk Telephones.....1'-6"
Wall-Mounted Telephone.....4'-6"
Weatherproof Outlets.....2'-2"
Disconnects, Branch Panelboards.....5'-0" max. to centerline
Fire Alarm Manual Stations.....3'-10"
Fire Alarm Audio and/or Visual Units80" AFF to bottom of device or 6" below ceiling, whichever is lower.

(7) The location of outlets, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon this Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to make his work fit the work of others and in order that when the devices or fixtures are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture or layout shall be coordinated with and approved by the Engineer before this change is made. Regardless of the orientation shown on the drawings, all devices shall be easily accessible when installed.

(8) Boxes installed in fire rated assemblies shall not compromise the rating of the assembly. The Contractor is responsible for identifying assembly ratings and construction requirements prior to rough-in.

a. Listed single and double gang metallic outlet and switch boxes with metallic or nonmetallic cover plates may be used in bearing and nonbearing wood stud and steel stud walls with rating not exceeding 2 h. The boxes shall be fastened to the studs with the openings in the wallboard facing cut so that the clearance between the boxes and the wallboard do not exceed 1/8 in. The boxes shall be installed so that the surface area of individual boxes do not exceed 16 sq in, and the aggregate surface area of the boxes do not exceed 100 sq in per 100 sq ft of wall surface unless approved alternate protection materials are used.

b. Boxes located on opposite sides of walls or partitions shall be separated by a minimum horizontal distance of 24 in. This minimum separation distance between the boxes may be reduced when listed Wall Opening Protective Materials are installed according to the requirements of their Classification.

c. Boxes installed on opposite sides of walls or partitions of staggered stud construction shall have listed Wall Opening Protective Materials installed with the boxes in accordance with Classification requirements for the protective materials.

d. All installation shall be done in accordance with AHJ requirements.

(9) All outlets, pull boxes, junction boxes, cabinets, etc., shall be sized per the current edition of the National Electrical Code.

B. Cabinets, outlet boxes and junction or pull boxes shall be threaded for rigid-threaded conduit, dust-tight, vapor-tight or weatherproof as required for areas other than for NEMA 1 or 1A application. These shall be as manufactured by Crouse-Hinds, Appleton, Killark, or approved equivalent.

(1) NEMA 1 or 1A cabinets, outlet boxes or pull or junction boxes shall be manufactured by Appleton, Steel City, T & B, or approved equivalent.

(2) Outlet boxes for switches, receptacles, telephone, etc., concealed in walls shall be galvanized steel, 2" X 4" X 2" with plaster cover for the number of devices as required. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or other masonry which will not be covered with plaster or in walls covered by wood wainscot or paneling, deep sectional masonry boxes shall be used and they shall be completely covered with the plates or lighting fixtures. This Contractor shall cooperate with the brick layers, block layers and carpenters to ensure that the outlet boxes are installed straight and snugly in the walls. Receptacles shall be set vertically in walls, unless noted otherwise.

(3) Outlet boxes mounted in glazed tile, brick, concrete block or other types of masonry walls shall be mounted above or below the mortar joint. Do Not Split The Mortar Joint.

(4) Boxes for more than two devices shall be for the number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.

(5) Outlets provided shall have only the holes necessary to accommodate the conduit at the point of installation and shall be rigidly secure in position. Boxes with knockouts removed and openings not used shall be replaced or be provided with a listed knockout closure.

(6) Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.

(7) Junction boxes, troughs, pull boxes or similar shall contain no more than three circuits. If boxes containing more circuits are deemed necessary for special circumstances such as fit or coordination, the Contractor shall contact the Engineer for written direction.

END OF SECTION 26 05 31

SECTION 26 05 33 - RACEWAY AND FITTINGS FOR ELECTRICAL SYSTEMS

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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. LFNC: Liquidtight flexible nonmetallic conduit.

F. RNC: Rigid nonmetallic conduit.

G. HCF: Healthare rated flexible metal conduit, with redundant ground path and green sheath.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets

C. Coordination Drawings: Conduit routing plans with BIM model in which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members in the paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

1.5 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. Aluminum Rigid Conduit: ANSI C80.5.

C. IMC: ANSI C80.6.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1
   2. Coating Thickness: 0.040 inch, minimum

E. EMT: ANSI C80.3.

F. FMC: Zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket.

H. HCF: Zinc-coated steel/aluminum.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
   2. Fittings for EMT: Set screw type fittings shall be utilized. Compression type shall be acceptable for conduits of any size.
   3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Type EPC-40-PVC or Type EPC-40-PVC unless otherwise indicated.

B. LFNC: Shall not be used without written permission of the Engineer.

C. Fittings RNC: NEMA TC 3; match to conduit or tubing type and material.

D. P.V.C. or other non-metallic conduit shall be rated for the maximum operating temperature that could be developed by the conductors it encloses, while in normal operation.

2.3 METAL WIREWAYS

A. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Hinged type.

D. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

2.5 CABLE TRAY

A. Section includes continuous, rigid, welded steel wire mesh cable management system.

1. ASTM A 510-General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.

2. ASTM B 633-Electrodeposited Coatings of Zinc on Iron and Steel.

B. Open Wire Mesh Cabletray System

1. Description: Continuous, rigid, welded steel wire mesh cable management system.
2. Mesh System: Permitting continuous ventilation of cables and maximum dissipation of heat.
3. Safety Edge: Continuous safety edge T-welded wire lip.
4. Wire Mesh: Welded at all intersections.
5. Material: Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture.
6. Finish for Carbon Steel Wire: Zinc electroplating. Finish applied after welding and bending of mesh.

C. Nominal Dimensions:

1. Nominal Mesh: 2 x 4 inches.
2. Width: 12 OR 18 inches as indicated on Drawings.
3. Depth: Four inches in depth.
4. Wire Diameter: Nominal .177 inch, minimum.
5. Maximum deflection between supports: L/240

D. Hardware: Hardware, including splice connectors, grounding fittings and support components to be furnished by the manufacturer.

E. Grounding: Provide grounding lugs for attachment on tray of continuous ground conductor fixing system.

F. Refer to Section 27 06 10 for required separation of tray and power wiring.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
D. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.
E. Nonmetallic Floor Boxes: Nonadjustable, round.
F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

I. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel
   2. Hinged door in front cover with flush latch and concealed hinge
   3. Key latch to match panelboards
   4. Metal barriers to separate wiring of different systems and voltage
   5. Accessory feet where required for freestanding equipment
      a. Ceiling outlet boxes shall be galvanized steel, 4" octagonal, not less than 2 1/8 IN deep, with lugs or ears to secure covers. Those for use with ceiling lighting fixtures shall be fitted with 3/8 IN fixture studs fastened to the back of the boxes, where applicable. Provide adequate support with at least a 2 x safety factor for the anticipated fixture weight.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. The decision of the Engineer shall be final and binding in any case where a question or inquiry arises regarding the suitability of a particular installation or application of raceways, supports or materials, if other than outlined herein.

B. Comply with the following indoor applications, unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed and Subject to Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
      a. Loading dock
      b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units
      c. Mechanical rooms
      d. Parking garages less than 10 feet above floor level
   3. Concealed in Ceilings and Interior Walls and Partitions: EMT or FMC as allowed by Code.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   5. Damp or Wet Locations: Rigid steel conduit or IMC.

6. Spaces Used for Environmental Air: Non-metallic conduit is prohibited.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Outdoor applications: RNC or rigid steel conduit. Use LFMC for final connection to vibrating equipment, where approved by the Engineer.

D. Minimum Raceway Size: 3/4-inch trade size except for communications cable.

E. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

F. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

G. Do not install aluminum conduits in contact with concrete.

H. The installer of raceway systems shall avoid the use of dissimilar metals within raceway installations that would result in galvanic-action corrosion.

3.2 INSTALLATION

A. Comply with NFPA 70 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

G. Raceways Embedded in Slabs:
1. Raceways shall not be installed within elevated concrete slabs or concrete slabs on grade without written permission of the Engineer.
2. Minimum trade size of raceways embedded in slabs shall be 1-inch trade size.

H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

K. Raceways for Optical Fiber, Fire Alarm and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows, where required by code to be installed in cable raceways:
   1. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
   2. Install a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
   1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
      b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F
      c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
      d. Attics: 135 deg F temperature change
   2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
   3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections to equipment: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC in damp or wet locations not subject to severe physical damage.

O. Weatherproof Flexible Metal Conduit shall be installed in such a manner that it will not tend to pull away from the connectors. Provide strain relief fittings equivalent to "Kellems" grips where subject to vibration or vertical runs.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set non-metallic floor boxes level. Trim after installation to fit flush with finished floor surface.

S. At least two 1 inch and four 3/4-inch conduits shall be stubbed from flush-mounted panelboards into the nearest accessible area for future use. Provide suitable closures for these stubs. Identify each stub with a suitable hang tag.

T. All exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. All conduit shall have supports spaced not more than eight feet apart.
   1. Where possible, parallel conduit runs shall be grouped to minimize the amount of area taken in a given space by adjacent conduit systems. Confirm routings with the engineer prior to installation for large parallel conduit system.

U. Conduit shall be installed in such a manner so as to insure against collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps. Trapped conduit runs shall be provided with explosion proof drains at low points. Runs of conduit between junctions shall not have more than the equivalent of three 90º bends.

V. Junction boxes shall be installed so that conduit runs will not exceed 85', as shown on the Contract Drawings.

W. Level and square raceway runs, and install at proper elevations and required heights. Hold tight to structure or route through joists webbing wherever possible, to maximize available space and not restrict other trades.

X. All raceways shall be installed to maintain a minimum of 4” clearance below roof decking.

Y. Complete installation of electrical raceways before starting installation of cables or wires within raceways.

Z. The location of outlets, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon this Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to make his work fit the work of others and in order that when the devices or fixtures are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture or layout shall be coordinated with and approved by the Engineer before this change is made. Regardless of the orientation shown on the drawings, all devices shall be easily accessible when installed.

AA. Outlet boxes for switches, receptacles, etc., concealed in walls shall be galvanized steel, 4 IN X 4 IN X 2 IN with plaster cover for the number of devices as required. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or other masonry which will not be covered with plaster or in walls covered by wood wainscot or paneling, deep sectional masonry boxes shall be used and they shall be completely covered with the plates or lighting fixtures. This Contractor shall cooperate with the brick layers, block layers and carpenters to insure that the outlet boxes are installed straight and snugly in the walls. Receptacles shall be set vertically in walls, unless noted otherwise.

BB. Outlet boxes mounted in glazed tile, brick, concrete block or other types of masonry walls shall be mounted above or below the mortar joint. Do Not Split The Mortar Joint.

CC. Boxes for more than two devices shall be for the number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.

DD. Outlets provided shall have only the holes necessary to accommodate the conduit at the point of installation and shall be rigidly secure in position. Boxes with knockouts removed and openings not used shall be replaced or be provided with a listed knockout closure.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07.

B. Provide sleeves for all penetrations, including core drilled holes. Floor slab sleeves be sealed watertight to floor.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:
   1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
   2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work. Work shall be performed in accordance with roof warranty requirements.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.4 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.
B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07.

3.6 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 44 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

1. GENERAL

   A. Each Contractor's attention is directed to Section 260501, General Provisions, Electrical and all other contract documents as they may apply to his work.

   B. Each Contractor shall include all excavating, filling, grading and related items required to complete his work as shown on the drawings and specified herein.

   C. Electrical distribution lines and underground telephone or TV cables shall, in no case, be placed in the same trench with sanitary, storm, domestic or fire protection water lines. Phone cable may, at the Contractor's option, and if acceptable to both utility companies, be placed in a common trench with power lines as long as 8" of earth separation is maintained. T.V. cable shall, in all cases, be placed in a separate trench with two feet separation from electrical power lines.

   D. Depths of bury shall be as indicated on the drawings.

2. SUBSURFACE DATA

   A. Subsurface investigations have been made and the results shown on the drawings. The information was obtained primarily for use in preparing foundation design. Each Contractor may draw his own conclusions therefrom. No responsibility is assumed by the Owner for subsoil quality or conditions other than at the locations and at the time investigations were made. No claim for extra compensation, or for an extension of time, will be allowed on account of subsurface conditions inconsistent with the data shown.

   B. Materials to be excavated shall be unclassified, and shall include earth, rock, or any other material encountered in the excavation to the depth and extent indicated on the drawings and specified herein. No adjustment in the Contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in the excavating.

3. BENCHMARKS AND MONUMENTS

   A. Maintain carefully all benchmarks, monuments and other referenced points. If disturbed or destroyed, replace as directed.

4. EXCAVATION

   A. Each Contractor shall accept the site as he finds it and remove all trash, rubbish and material from the site prior to starting excavation for his work.

   B. Excavate trenches to sufficient width and depth for proper installation of the work and where required, smooth the bottom on the trench with hand tools.

C. The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted unless authorized in writing by the Architect. Any damage to existing structures, exterior services or rock intended for bearing, shall be corrected at the responsible Contractor's expense.

D. Keep trenches free from water while construction therein is in progress. Under no circumstances lay conduit or cable in water. Pumping or bailing water from this Contractor's trenches, which is required during construction shall be accomplished at his expense.

E. In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, etc. Each Contractor shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage, or any other damage incurred in the course of excavation, shall be borne by the responsible Contractor.

F. Directional boring shall be an acceptable method for routing out underground raceways, if approved by the Engineer. This contractor shall provide specifications for boring methods, including depth and a drawing indicating the routing of all bored raceways.

5. BACKFILL

A. Backfill shall be accomplished with clean debris free earth and the new earth tamped at 12" intervals so as to avoid earth sinks along the trench. The responsible Contractor will be required to return to the project and fill any sunken areas along the route of his work.

B. Backfill trenches only after conduit and cable have been inspected, tested, and locations of pipe lines have been recorded on "as-built" drawings.

C. The backfill below paved areas shall be brought to proper grade to receive the sub-base and paving. No paving shall be placed on uncompacted fill.

D. The backfill below sodded or seeded areas shall be brought to within six inches of finished grade. The remaining six inches shall be backfilled with clean soil.

END OF SECTION 26 05 44

SECTION 26 05 53 - IDENTIFICATIONS

1. GENERAL

A. Equipment, disconnect switches, motor starters, pushbutton stations, special device plates, and similar materials shall be clearly marked as to their function and use. Markings shall be applied neatly and conspicuously to the front of each item of equipment with 1/2" white lamacoid plate (or equivalent) with black (or red for emergency power) letters 1/4" high.

B. The Contractor shall provide clearly legible typewritten directories in each electrical panel indicating the area, item of equipment, etc., controlled by each switch, breaker, fuse, etc. These directories are to be inserted into plastic card holders in each panel. The Contractor shall be required to demonstrate the accuracy of the panel directory for a random sampling of circuits in each panelboard as directed in the field by the Engineer with corrections made immediately so it is imperative that care be taken during installation to insure 100% accurate directories.
   (1) Room numbers shall match the final numbering as indicated by building signage and owner-approved numbering scheme.
   (2) The contractor shall provide electronic copies of all final schedules in Excel or Word format at project closeout.

C. All circuit breakers and disconnects serving fire alarm equipment shall be painted red and clearly labeled as Fire Alarm Circuits.

D. Branch circuit panelboards and switch gear shall be provided with a white lamacoid plastic plate with 1/2" black (or red for emergency power) letters for panel designation and 1/4" letters showing voltage and feeder information. Branch circuit switches shall be designated as to function. Panelboard and switchgear labels shall indicate the source they are fed from, and the circuit number at that source. Panelboards shall also indicate color coding of the branch circuit phase conductors supplied. Clearly indicate the exact label legend to be furnished with each panelboard and switchgear on the shop drawings for each item of equipment prior to submission of shop drawings.

EXAMPLE:

PANEL “XYZ” FED FROM “MDP – 2” 120/ 208/ 3PH/ 4W – 225A BLACK-RED-BLUE CONDUCTORS

E. Where branch circuit panelboards and switchgear are connected to an emergency source, the lamacoid plate shall be red, and the word "emergency" shall be incorporated into the legend. In healthcare applications, the NEC – designated branch (life safety, critical or

equipment branch) shall also be incorporated into the legend, all in ¼" letters. Also provide similar plates and legends for automatic transfer switches, and equipment disconnects 100 amps and larger.

F. Lamacoid plates shall be located at center of top of trim for branch circuit panels, switch gear, and centered at side for branch circuit switches. Fasten with self-tapping stainless-steel screws or other approved method.

G. The building service disconnect(s) shall be marked with the maximum available fault current available at that location in accordance with NEC Article 110. If a fault current study is not required by this contract, the Contractor shall obtain fault current availability data from the utility company. This requirement applies to both new and existing services if any distribution equipment is changed.

H. All receptacles and light switches shall be labelled with the circuit number. Labelling shall be by printed adhesive label with clear background and black capitalized 3/16" high lettering.

I. All disconnects, enclosed breakers, motor starters and VFDs shall be labelled with the supplying circuit number. Markings shall be applied neatly and conspicuously to the front of each item of equipment with 1/2" white lamacoid plate (or equivalent) with black (or red for emergency power) letters 1/4" high.

J. All fire alarm and security addressable devices shall be labelled with their unique address. Labelling shall be by printed adhesive label with clear background and black capitalized 3/16" high lettering.

END OF SECTION 26 05 53

SECTION 26 05 73 - ELECTRICAL STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. All services, materials and installation shall comply with the owners' construction standards. Special attention shall be given to Divisions 02, 16 and 17. In the event of a conflict between these standards and the Contract Documents the most stringent requirement shall be met.

C. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.

D. Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 SUMMARY

A. This Section includes computer-based, fault-current, arc flash and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

B. Electrical Studies shall be performed by the Low-Voltage Switchboard manufacturer. All Electrical Studies required by this specification shall be completed within five (5) weeks from award of project. The Electrical Contractor shall provide all required data to Low-Voltage Switchboard manufacturer within one (1) week and the manufacturer will have four (4) weeks to complete the studies.

C. A licensed professional engineer employee of the Low-Voltage Switchboard manufacturer shall provide electrical power system studies for the project using the latest version of one of the approved software packages. The software model files shall be submitted with the report. The analysis shall follow the latest IEEE 1584 guidelines. An example report will be provided by the university upon request.

D. Studies specified herein must be submitted and approved prior to release of any affected equipment. Revisions to equipment or devices necessary to meet study recommendations shall be at the Manufacturer's expense.

E. All adjustments and settings recommended by these studies shall be made prior to any testing.

F. The analysis shall be submitted to the engineer of record prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing.

1.3 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-study specialist.

D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study Report.

E. Owners Record Copy: The as-built software model and all electronic files are to be provided to the owner at project closeout. Electronic files are to be compatible with the latest version of SKM software. The owner shall receive rights to use and/or modify the electronic files and data for operations planning, maintenance and modification of their electrical system.

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

1.5 Commissioning

A. This section specifies a system or a component of a system being commissioned as defined in Section 019113 Commissioning. Testing of these systems is required, in cooperation with the Owner and the Commissioning Authority. Refer to Section 019113 Commissioning for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Computer Software Developers: Software utilized shall be capable of converting all data to SKM formatting. Subject to compliance with requirements, provide products by one of the following:

1. CGI CYME.
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology, Inc.
5. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
    a. Circuit-breaker and fuse-current ratings and types.
    b. Relays and associated power and current transformer ratings and ratios.
    c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
    d. Generator kilovolt amperes, size, voltage, and source impedance.
    e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
    f. Busway ampacity and impedance.
    g. Motor horsepower and code letter designation according to NEMA MG 1.
4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.

f. Special overcurrent protective device settings or types stipulated by utility company.
g. Time-current-characteristic curves of devices indicated to be coordinated, including arc-reduction features where applicable.
h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

B. Data shall be obtained for the power sources (utility system and generators), impedance components (transformers, cables and busway), overcurrent protective devices (fuses, circuit breakers and relays) and other relevant equipment such as automatic transfer switches. Cable data (length, quantity per phase, size and type) shall be provided by the electrical contractor. Assumptions should only be used when the actual data is not available and the assumptions should be clearly listed in the report. Assumptions shall be kept to a minimum.

C. A one-line diagram shall be provided as part of the analysis and shall clearly identify individual equipment buses, bus numbers used in the analysis, cable information (length, quantity per phase, size and type), overcurrent device information (manufacturer, type and size), transformers, motors, transfer switches, generators, etc.

D. The one line and analysis shall use a numbering scheme where each bus begins with a three digit number followed by a description (e.g., 102 MDPA or 103 ELEV DISC) and each connected circuit breaker or fuse shall have a corresponding designation (e.g., 102-1 MAIN CB, 102-2 ELEVATOR FDR or 103-1 ELEV DISC CB).

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

1. Switchgear and switchboard bus
2. Medium-voltage switch and transformers
3. Distribution panelboards
4. Branch circuit panelboards
5. Variable Frequency Drives
6. Motor Control Centers
7. Company switches
8. Fused and non-fused disconnects
9. Low-voltage transformers
10. Individual circuit breakers
11. Combination starter/disconnects

B. Study electrical distribution system from normal and alternate emergency power sources throughout electrical distribution system for Project, using approved computer software

program. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.

1. Transformers:

a. ANSI C57.12.10
b. ANSI C57.12.22
c. ANSI C57.12.40
d. IEEE C57.12.00
e. IEEE C57.96

2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
3. Low-Voltage Fuses: IEEE C37.46.
4. Circuit Breakers: IEEE c37.13.

E. Study Report: Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

F. Equipment Evaluation Report:

1. For overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

G. A table shall be included which lists the calculated short-circuit currents (rms symmetrical three phase), equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment at each bus.

H. Any inadequacies shall be called to the attention of the engineer of record and recommendations made for improvements as soon as they are identified.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 242 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:
    a. Inrush current when first energized.
    b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
    c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Motors served by voltages more than 600 V shall be protected according to IEEE 620.

E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
    a. Device tag.
    b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
    c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
    d. Fuse-current rating and type.
    e. Ground-fault relay-pickup and time-delay settings.
2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
    a. Device tag.
    b. Voltage and current ratio for curves.
    c. Three-phase and single-phase damage points for each transformer.
    d. No damage, melting, and clearing curves for fuses.
    e. Cable damage curves.
    f. Transformer inrush points.
    g. Maximum fault-current cutoff point.

G. Completed data sheets for setting of overcurrent protective devices.

H. A table shall be included which lists the recommended settings of each circuit breaker and relay.

I. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.

J. Deficiencies in protection and/or coordination shall be called to the attention of the engineer of record and recommendations made for improvements as soon as they are identified.

K. The electrical engineer that performed the study shall be responsible to set the circuit breakers according to the analysis once the report has been approved by the engineer of record.

3.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

B. The analysis shall consider multiple possible utility scenarios as well as multiple system configurations where appropriate such as normal and emergency transfer switch positions and different main-tie-main configurations. Where manually activated arc energy reduction means are utilized, the analysis shall calculate energy available downstream for normal operation and for maintenance mode operation.

C. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system. This includes all switchboards, switchgear, motor-control centers, panelboards, busway and splitters.

D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm^2.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not taken into consideration when determining the clearing time when performing incident energy calculations.

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment locations. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.

2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

L. Incident energy and flash protection boundary calculations

1. Arcing fault magnitude
2. Protective device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendation for arc flash energy reduction

M. The Arc Flash Hazard Analysis shall include recommendations for reducing Arc Flash Incident Energy (AFIE) levels and enhancing worker safety.

N. Results of the Arc Flash Hazard Analysis shall be submitted in tabular form and shall include the following information for each bus location: bus name, protective device name, bus voltage, bolted fault, arcing fault, trip/delay time, equipment type, working distance, arc flash boundary, incident energy and protective clothing category.

3.6 ARC FLASH WARNING LABELS

A. Arc flash labels shall be furnished and installed by the contractor of the Arc Flash Hazard Analysis.

B. The labels shall be 4 inches high by 6 inches wide and printed on a Brady THTEL-25-483-1-WA label type or similar. The arc flash label shall be as required by NFPA 70E or as required by the owner’s standards.

C. After labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.

3.7 Labels shall be machine printed, with no field markings.

3.8 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings. Provide one arc flash label for all electrical equipment including:

A. For each 480 and applicable 208-volt panelboard, one arc flash label shall be provided.

B. For each 480 and applicable 208-volt distribution panelboard, one arc flash label shall be provided.

C. For each motor control center, one arc flash label shall be provided.

D. For each low-voltage switchboard, one arc flash label shall be provided.

E. For each switchgear, one flash label shall be provided.

F. For medium voltage switches and transformers, one arc flash label shall be provided.

G. For each fused or non-fused disconnect switch, one arc flash label shall be provided.

H. For each generator and automatic transfer switches, one arc flash label shall be provided.

I. For each variable frequency drives, one arc flash label shall be provided.

J. For each combination starter/disconnects, one arc flash label shall be provided.

K. For each fused or non-fused disconnect switch and individual circuit breakers, one arc flash label shall be provided.

L. For each low-voltage transformer, one arc flash label shall be provided.

M. For each company switch, one arc flash label shall be provided.

END OF SECTION 26 05 73

SECTION 26 09 43 - DIGITAL NETWORK LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Installed system shall be comprised of stand-alone and networked control devices as indicated. System control devices shall include, but are not limited to:
   a. Digital Room Controllers
   b. UL924 Load Controller
   c. Fixture Control Modules
   d. Lighting Control Panels
   e. Sensors
   f. Wall Stations
   g. Network Area Controller
   h. Network Modules
   i. Network Accessories
   j. Software Interfaces
   k. Conductors and Cabling

1.2 SYSTEM DESCRIPTION

A. The contractor shall provide and install NX Lighting Controls System as shown on plans and specified herein. NX Lighting Controls System shall be designed and configured to send and receive control, monitoring, operating and maintenance signals and commands wired and or wirelessly to and from networked enabled room controllers, fixture modules, switch stations, occupancy and daylight sensors, lighting control panels and other controls devices.

1.3 SUBMITTALS

A. Prior to fabrication and shipment of lighting control components, manufacturer shall provide submittal documentation for approval.

B. Submittal documentation shall include:
   1. Bill of Material including a list of components to be supplied,
   2. Device specification sheets indicating device features, certifications, dimensions, construction specifications, electrical specifications, wiring diagrams, nomenclature, and related products,
   3. Component schedules: Indicating lighting control device types and locations
   4. Lighting panel schedules,
   5. Wiring diagrams,
   6. Control cable type and routing requirements,
   7. System riser drawings of sufficient detail to indicate relative placement of major system components and the required connections between each,
   8. Contractor Startup Request Form – to be completed prior to factory startup,
   9. Operating and maintenance instructions, manuals and/or videos.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualification: Manufacturer of lighting control devices with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.

1. Approval of Comparable Products: Submit the following at least 10 days prior to submission of a proposal package. Substitution submitted without the below shall be rejected.
   a. Submit line-by-line comparison that describes differences, if any, between each lighting control device specified and those being proposed. Comparison shall include differences in size, quantity, quality, method of control, features and functions, control software functions, and installation requirements.
   b. Product data, including certified independent test data indicating compliance with requirements.
   c. Samples of each component.
   d. Project references: Minimum of 3 installations not less than 3 years old, with Owner and Architect contact information.
   e. Sample warranty.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.

B. Factory Assembly: All system components shall arrive at the job site completely pre-wired and ready for installation, requiring only the connection of lighting circuits and network terminations. All connections shall be made to clearly and permanently labeled termination points or by connectorized cable. Systems that required field assembly shall not be acceptable.

C. Component Testing: All system components and assemblies shall be individually tested prior to assembly. Once assembled, all finished products shall be tested for proper operation of all control functions per specifications prior to shipment.

1.5 SYSTEM COMPLIANCE

A. Compliance: Where indicated, individual components shall comply with the following requirements:
   1. NEC Compliance: All system components shall comply with all applicable sections of the National Electrical Code (NEC) NFPA 70 as required.
   2. NEMA Compliance: All system components shall comply with all applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
   3. UL Approval: All applicable equipment shall be tested to and listed under UL standard 508, UL standard 916 or UL924 and shall bare labels to indicate compliance. Lighting control relays shall be tested to UL standard 508 for both safety and endurance. Systems listed under ETL or other UL sections shall provide documentation proving compliance with UL standards as listed above.
   4. FCC Emissions: All applicable equipment shall comply with FCC emissions standards specified in Part 15, sub-part j for commercial and residential

applications and shall bear labels indicating compliance testing. Equipment that does not meet these standards shall not be acceptable.

1.6 WARRANTY

A. Manufacturer shall warrant the lighting control system components to be free from defects in material and workmanship for a period of five (5) years from the date of the certificate of building occupancy or proof of installation, whichever occurs first ("Warranty Period"). If the certificate of building occupancy is not available or there is no proof of installation, the Warranty Period shall begin with the Product ship date.

B. Manufacturer's warranty shall include the repair or replacement product(s) with the same or a functionally equivalent product(s) or component part(s).

C. Manufacturer shall provide telephone technical support and remote diagnostics where applicable during normal business hours excluding manufacturer holidays.

D. Upon request, Manufacturer shall provide quotation for manufacturer service contract option(s) which include on-site technician visits for service and repair.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers
1. Current
2. nLight (Lithonia)
3. Cooper Controls
4. Other engineer and owner approved alternates.

B. Basis-of-Design: NX Lighting Controls System manufactured by HLI Solutions, a division of Current, Greenville SC.

2.2 SYSTEM ARCHITECTURE

A. System shall consist of wired and/or wireless, distributed intelligent lighting control devices consisting of but not limited to control modules with ON/OFF, full range dimming and CCT control capabilities, and system input devices including but not limited to occupancy/vacancy sensors, daylight sensors and manual switch stations.

B. System shall provide for automatic self-configuration of system devices. Self-configuration shall be accomplished by the devices themselves and provide for control of lighting prior to system custom configuration and programming. Systems that require configuration prior to use shall be considered unacceptable.

C. To implement lighting control strategies, the system architecture shall facilitate the association of system input devices to control modules. The system shall use the Area/Zone/Group assignment strategy. The system shall support up to 128 Areas. Each area shall consist of up to 128 Zones and each zone shall consist of up to 16 Groups.

Each device may be programmed to participate in one Area and Zone however may belong to one or more of the available 16 Groups within a Zone.

D. System shall provide time-of-day and astronomical clock scheduling. Each Area/Zone shall support up to 99 scheduled events for use in developing time-of-day or astronomical clock sunrise/sunset automated schedules. Each schedule shall have the ability to turn a group ON or OFF or activate a preset lighting scene at a scheduled time. Schedules shall be day-of-week selectable and may be programmed to activate on any combination of days of the week (Sunday through Saturday) or to activate on a specific date/holiday.

E. System shall support blink alerts. Relay outputs within the control modules shall be programmable to blink prior to being turned OFF. Blink alert duration time shall be adjustable. Control modules programmed for the blink alert function shall blink the controlled lighting prior to turning OFF to warn occupants of the upcoming OFF event. If an ON command is received during the blink alert time, relay output will be overridden and left ON for the override time. Override time shall be adjustable.

F. System input devices shall be deployed in a space to monitor and broadcast changes such as occupancy, daylight levels and manual switch input.

G. System customization and programming shall be performed from a mobile App and/or web-based configuration and system management tools.

H. System shall have an intuitive and easy to use Graphical User Interface (GUI) to configure, control, monitor and schedule individual devices or groups of devices.

I. System shall remain fully functional during the programming process. Lighting control systems that must be taken “OFFLINE” for programming are not acceptable. All programming changes shall take effect immediately as they are programmed.

J. System shall be capable of being accessed from a local network or remotely using any standard Internet browser. System shall not require any special client-side software. Systems which utilize special client-side software shall not be acceptable.

K. Systems devices shall be capable of communication with each over one or all of the below methods.
   1. RS485 multidrop serial network
   2. Wireless mesh network
   3. Ethernet TCIP network

L. Wired – RS485/Ethernet
   1. System shall provide an Ethernet communication backbone (NX Network) for the connection of control Zones.
   2. System shall utilize the RS485 standard for connection of and communications between Zone Devices.
   3. System shall utilize the RS485 standard for connection of and communications between SmartPORT™ devices (e.g., Sensors, Switches and Accessories) connected within a NX Zone.

M. Wireless – Coordinator-less, Self-Organizing/Self-Healing Mesh
   1. System shall have a wireless architecture that utilizes wireless mesh radio technology to create a peer-to-peer, self-organizing and self-healing mesh network infrastructure.
   2. System shall have no single point of failure. A master controller/coordinator or master node shall not be required for proper system operation. All nodes shall be capable of communicating with each other without the need of these types of single point of failure devices. Systems which utilize a master controller/coordinator shall not be acceptable.
   3. System shall be self-organizing. The mesh network of devices shall self-organize automatically without the need to manually set device addresses via dials, DIP switches or other means.
   4. System shall be self-healing. System devices within the mesh network shall automatically reroute messages around a failed device to ensure message delivery.
   5. System architecture shall facilitate data transmission between wireless devices over the 2.4GHz ISM radio frequency (RF) band with a supported RF range of 100ft between wireless devices indoors and 300ft outdoors.
   6. System shall use a wireless mesh radio communication protocol to transmit/receive and negotiate messaging among wireless devices.
   7. System shall utilize spread spectrum frequency hopping to facilitate robust communication and prevent the unauthorized interception of messages over the air and to comply with FCC requirements.
   8. System shall provide the ability to secure messages. When implemented, each device shall use the strong and secure AES-128 (Advanced Encryption Standard) security cipher to encrypt and decrypt messages. System shall also use the secure HTTPS/SSL protocol when users access the system using their Internet browser.

N. System devices shall be capable of having their firmware updated or upgraded over the air through the wireless mesh network.

2.3 DIGITAL ROOM CONTROLLERS

A. NX Room Controllers
   1. Basis of Design Product: NX Lighting Controls System, NX Room Controllers.
   2. As indicated and where shown on the plans, install NXRC series Room Controller(s) to control the quantity of lighting and plug loads required.
   3. NX Room Controller(s) shall integrate the functionality of connected control components including wall switch stations, occupancy sensors and daylight sensors to provide the required sequence of operation for the space.
   4. NX Room Controller(s) and associated room control components shall operate in a totally standalone mode and not require the use of a network, software, computer, or server for local control functions.
   5. NX Room Controller(s) shall have an embedded Time Clock and be capable of storing and running up to 99 local schedules. Schedules shall run autonomously without the need of any coordinator, gateway, or master controller.
   6. Construction:
      a. NX Room Controller housing shall be constructed of GSM UL rated 94 HB plastic approved for use in a return air plenum.

b. The housing and shall include an integral 1/2" chase nipple for external mounting to standard junction box knockout.
c. Two RJ45 FX Port connectors shall be accessible on the side of the enclosure for expansion of a Zone Segment to allow for an expanded number of Zone Segment devices (e.g., Room Controllers, In-Fixture Modules, and Digital Sensors). Up to 32 controllers and devices can be daisy-chained together.
d. Two RJ45 SmartPORT™ connectors shall be accessible on the side of the enclosure for the connection of NX room level devices.
e. Two recessed push buttons and associated LED indicators shall be accessible on the top of the enclosure to provide override, status, setup, and testing functions.

7. Electrical:
   a. NX Room Controller(s) shall have a single power feed and shall be capable of operation at voltages between 120/277/347 volts AC, 50/60 Hz.
   b. One or two output relays (model specific) shall provide for the following load types and ampacity (per relay):
      1) 20A, Tungsten,
      2) 20A, Magnetic Ballast,
      3) 16A, Electronic Ballast,
      4) 1 H.P. Motor @ 120V, ¾ H.P. @ 277V; ½ H.P. @ 347V
   c. Where indicated provide one or two independent 0-10 volt dimming channels (model specific) for full range dimming control of fixtures equipped with compatible dimmable ballast or driver.
   d. Each dimming output shall have a current sinking capacity of at least 30 mA.
   e. NX Room Controller(s) shall be capable of supplying 250 mA of Class 2 auxiliary DC power for use by wall switch stations, occupancy sensors, and daylight sensors connected to the room controller's two RJ45 SmartPORT connectors.
   f. NX Room Controller(s) shall be equipped with power monitoring circuitry capable of measuring and reporting the total connected load for each room controller.
8. Functional:
   a. Provide an integral pushbutton and LED indicator for each load for status and allow operation of the relays and dimmers for testing and verification without requiring other control devices to be connected.
   b. NX Room Controller(s) shall have a default operation providing an automatic logical sequence of operation for each load as the room control devices are plugged into the SmartPORT connectors.
   c. Default operation for occupancy sensors shall be automatic on, automatic off for all loads.
   d. Upon connection of a switch, the operation shall automatically change to manual on, automatic off (vacancy) mode for all loads.
   e. Provide capability to convert each load independently to automatic on or vacancy mode using only the integral push buttons and LED indicators on the room controller.
   f. When in vacancy mode, provide a 30 second grace period after an off during which automatic on shall be temporarily enabled.

g. It shall be possible to connect up to thirty-two (32) room controllers together on the FX Ports using Cat5 patch cables to provide configurations up to 64 switched and dimmed loads operating as a single zone.
h. Provide the following set up and configuration functions without the need for additional devices or software:
    1) Assign/reassign relays for control by wall switch station buttons,
    2) Configure relays and dimmers for occupancy or vacancy operation with support for a grace period and schedule-based occupancy sensor settings based on programmed primary and secondary times,
    3) Assign/reassign dimmers to raise/lower switches,
    4) Assign dimming channels for response to daylight sensor control,
    5) Auto calibrate default daylight sensor sequence of operation,
    6) Save preset scenes.

9. NX Room Controller(s) shall support the following specialty modes:
    a. SpectraSync™ CCT Control
        1) Dimmer channels can be set individually to control CCT via 0-10V.
        2) Scheduling can be implemented to mimic the natural transition of light throughout the course of the day.
        3) Room-based solutions can be implemented to allow occupants to tune color to task.
    b. SpectraClean™
        1) Ability to control SpectraClean enabled fixtures with three different modes for varying applications:
            a) Constant On
            b) Scheduled
            c) Programmed Dosage

2.4 UL924 LOAD CONTROLLER

A. NX UL924 Load Controller
1. Basis of Design Product: NX Lighting Controls System, NX UL924 Load Controller.
2. As indicated and where shown on the plans, install NX UL924 Load Controller to control the quantity of emergency lighting loads required.
3. NX UL924 Load Controller shall meet NFPA Article 700 requirements for emergency lighting.
4. NX UL924 Load Controller and associated room control components shall operate in a totally standalone mode and not require the use of a network, software, computer, or server for local control functions.
5. NX UL924 Load Controller shall provide a remote test button or fire alarm interface.
6. NX UL924 Load Controller shall have an embedded Time Clock and be capable of storing and running up to 99 local schedules. Schedules shall run autonomously without the need of any coordinator, gateway, or master controller.
7. Construction:
    a. NX UL924 Load Controller housing shall be constructed of GSM UL rated 94 HB plastic approved for use in a return air plenum.
    b. The housing and shall include an integral 1/2" chase nipple for external mounting to standard junction box knockout.
    c. Two RJ45 FX Port connectors shall be accessible on the side of the enclosure for expansion of a Zone Segment to allow for an expanded number of Zone Segment devices (e.g., Room Controllers, In-Fixture

Modules, and Digital Sensors). Up to 32 controllers and devices can be daisy-chained together.

d. Two recessed push buttons and associated LED indicators shall be accessible on the top of the enclosure to provide override, status, setup, and testing functions.

8. Electrical:
   a. NX UL924 Load Controller shall have a single power feed and shall be capable of operation at voltages between 120/277/347 volts AC, 50/60 Hz.
   b. One relay output shall provide the following load types and ampacity:
      1) 20A, Tungsten,
      2) 20A, Magnetic Ballast,
      3) 16A, Electronic Ballast,
      4) 1 H.P. Motor @ 120V, ¾ H.P. @ 277V; ½ H.P. @ 347V.
   c. NX UL924 Load Controller shall provide two independent 0-10 volt dimming channels for full range dimming control of fixtures equipped with compatible dimmable ballast or driver.
   d. Each dimming output shall have a current sinking capacity of at least 30 mA.
   e. NX UL924 Load Controller shall be equipped with power monitoring circuitry capable of measuring and reporting the total connected load for each room controller.
9. Functional:
   a. SmartPORT Functionality:
      1) NX UL924 Load Controller shall automatically recognize connected devices in the Zone Segment.
      2) NX UL924 Load Controller shall function as a standard room controller.
      3) NX UL924 Load Controller's RJ45 CAT5 connection shall be used as a sensing line to standard room controller only and does not support NX room devices.
   b. Emergency Functionality:
      1) NX UL924 Load Controller's RJ45 CAT5 connection shall be used as a sensing line to standard room controller on normal circuit.
      2) Removal of 24VDC on CAT5 connection shall put NX UL924 Load Controller into emergency state.
      3) NX UL924 Load Controller's default emergency state is ON with both dimming channels to 100%
   c. Provide an integral pushbutton and LED indicator for controlled load for status and to allow operation of the relay and dimmers for testing and verification without requiring other control devices to be connected.
   d. Provide the following set up and configuration functions without the need for additional devices or software:
      1) Assign/reassign relays for control by wall switch station buttons,
      2) Configure relays and dimmers for occupancy or vacancy operation with support for a grace period and schedule-based occupancy sensor settings based on programmed primary and secondary times,
      3) Assign/reassign dimmers to raise/lower switches,
      4) Assign dimming channels for response to daylight sensor control,
      5) Save preset scenes.
10. NX UL924 Load Controller shall support the following specialty modes:
    a. SpectraSync™ CCT Control
       1) Dimmer channels can be set individually to control CCT via 0-10V.

2) Scheduling can be implemented to mimic the natural transition of light throughout the course of the day.
3) Room-based solutions can be implemented to allow occupants to tune color to task.

b. SpectraClean™
1) Ability to control SpectraClean enabled fixtures with three different modes for varying applications:
a) Constant On
b) Scheduled
c) Programmed Dosage

2.5 FIXTURE MODULES

A. NX In-Fixture Modules
1. Basis of Design Product: NX Lighting Controls System, NX In-Fixture Modules.
2. As indicated in the specifications and as shown on the plans, install NXFM series Fixture Control Module enabled fixture(s).
3. NX In-Fixture Modules shall be designed to install inside the fixture they control.
4. NX In-Fixture Modules shall consist of a completely distributed intelligent lighting controller capable of functioning completely independently including time based and astronomical scheduling of On/Off and preset events without the need of any coordinator, gateway or master controller. Sensors and switches as well as other NX In-Fixture enabled fixtures shall be capable of being connected directly to the NX In-Fixture Module to create a fully functional lighting control system.
5. NX In-Fixture Module shall be provided with one SPST relay. Relay shall be supplied with “Zero Cross Switching” control to limit the effects of inrush on the relay contacts.
6. NX In-Fixture Module shall be compatible with incandescent, magnetic, and electronic lighting loads including LED drivers. NX In-Fixture Module shall include zero arc point switching circuitry and have the following max load ratings:
7. Construction:
a. Housing: GSM UL Rated 94 HB Plastic
b. Mounting: Mounts inside fixture
8. Electrical:
a. Line Voltage Versions:
1) Input: Universal 120-347VAC, 50-60Hz
2) Output: One or two relay outputs (model specific) shall provide for the following load types and ampacity (per relay):
a) 10A, 120VAC only Incandescent
b) 10A, 120-347VAC, Magnetic Ballast
c) 5A, 120-277VAC, Electronic Ballast
d) 3A, 347VAC, Electronic Ballast
3) Surge Withstand: 2000V
4) Peak Inrush: 160A for 2 ms Max
b. Low Voltage Versions:
1) Input: 12-24VDC
c. NX In-Fixture Modules shall be provided with two 0-10VDC control interfaces for full range dimming control of dimming ballasts and LED drivers. Interface shall be designed to continuously sink 30mA of current.

d. NX In-Fixture Module 0-10VDC control interfaces shall be configurable for 0-10VDC dimming, dim to off or color temperature control.

9. Functional:
   a. NX In-Fixture Modules shall be designed to self-configure, automatically to meet energy code requirements as NX sensors and other NX devices are connected.
   b. NX In-Fixture Module shall be designed such that self-configuration takes place automatically without user intervention or commissioning of any kind.
   c. NX In-Fixture Modules shall be rated and tested for an operating temperature range of -40° to 185°F [-40° to 85°C].
   d. NX In-Fixture Module shall be equipped with a Real Time Clock and integral backup for schedule information. Each module shall support up to 99 schedules. Schedules shall be loaded to the module via the network or locally using the NX Lighting Controls Mobile App. Once loaded, schedules shall run autonomously without the need of any coordinator, gateway, or master controller.
   e. NX In-Fixture Module shall be capable of having its device firmware updated wirelessly over the air when connected to an NX sensor via the NX SmartPORT.
   f. NX In-Fixture Modules shall be supplied with one momentary pushbutton with LED for manual control and testing. Using this switch, it shall be possible to test the On/Off and dimming functionality of the NX In-Fixture module or completely reset the NX In-Fixture Module to factory defaults without the need to connect any other device or testing equipment.
   g. NX In-Fixture Module shall include non-volatile memory for retaining device settings during power outages.
10. NX In-Fixture Module shall be UL Listed to UL916 and Certified to CAN/CSA C22.2 NO 205-M1983.
11. NX In-Fixture Module shall be FCC certified.

B. NX On-Fixture Modules
   1. Basis of Design Product: NX Lighting Controls System, NX On-Fixture Module.
   2. As indicated in the specifications and as shown on the plans, install NXOFM2 series wireless On-Fixture Control Module(s).
   3. NX On-Fixture Modules shall consist of a completely self-contained distributed intelligent wireless lighting controller capable of functioning completely independently including time based and astronomical scheduling of On/Off and preset events without the need of any coordinator, gateway or master controller.
   4. NX On-Fixture Module shall include an integrated photocell for daylight harvesting applications.
   5. NX On-Fixture Module shall include an integral astronomical timeclock for running scheduled events.
   6. NX On-Fixture Module shall include an auxiliary input for external control.
   7. NX On-Fixture Module shall be configurable remotely over the air utilizing built in Bluetooth radio an iOS or Android handheld device with the NX Lighting Controls Mobile App installed or via NX Wireless Network.
   8. NX On-Fixture Module shall be capable of having its device firmware updated wirelessly over utilizing its built-in Bluetooth radio and iOS or Android handheld device with the NX Lighting Controls Mobile App installed or via NX Wireless Network.

9. On-Fixture Module shall respond to scheduled events, occupancy/vacancy sensor events and manual switch station events.
10. On-Fixture Module shall monitor and measure energy consumption.
11. On-Fixture Module shall include non-volatile memory for retaining device settings during power outages.
12. NX On-Fixture Modules shall be rated and tested for an operating temperature range of -40° to 158°F [-40° to 70°C].
13. NX On-Fixture Module shall include one SPST relay for On/Off control.
14. NX On-Fixture Module relay shall be supplied with “Zero Cross Switching” control to limit the effects of inrush on the relay contact.
15. NX On-Fixture Module shall be compatible with incandescent, magnetic, and electronic lighting loads including LED drivers.
16. Construction:
    a. Housing: UV Stable - GSM UL Rated 94 HB Plastic
    b. Mounting: Standard NEMA C136.10/C136.41 Receptacle
17. Electrical:
    a. Input: 120-480VAC, 50-60Hz
    b. Output: Relay output shall provide for the following load types and ampacity:
        1) 10A, Tungsten, 120VAC
        2) 5A, Standard Ballast, 120-347VAC
        3) 5A, Electronic Ballast, 120-277VAC
        4) 3A, Standard Ballast, 347VAC-480VAC
    c. Surge/In-Rush:
        1) Surge Protection: 10kV Max
        2) Peak In-Rush: 160A for 2ms Max
    d. Low Voltage Output:
        1) 12VDC, 100mA, Isolated, and Short Circuit Protected
    e. Dimming:
        1) 0-10V, 50mA, Current Sink
    f. Power Metering:
        1) NXOFM2 is factory calibrated to provide power metering accuracy of +/- 5% (Rating assumes standard load within specified voltage and temperature rating for NXOFM2; all values provided in Watts)
18. Operating Environment:
    a. Operating Temperature: -40° to 158°F (-40° to 70°C)
    b. Relative Humidity (non-condensing) 0% to 95%
        1) IP65 Rated
19. Wireless:
    a. 2.4GHz; IEEE 802.15.4 based
    b. Bluetooth Version 5.2 (Range: Up to 50ft clear line of sight)
    c. Radio Range: ~300ft (91m) Note: Range Based on Clear Line of Sight
    d. Recommended Deployment Practice: Locate at least three (3) radios within a 300ft radius for most reliable performance
20. Programming Interface:
    a. NX Lighting Controls Mobile App
    b. NX Site Manager (NXAC2-120-SM) for Network Applications
21. Integrated Photocell:
    a. On Level: 1FC to 5FC (Default: 5FC)
    b. Off Level: 4FC to 15FC (Default: 8FC)
22. Certifications:

a. cULus Listed
b. Complies with FCC Part 15.247
    1) FCC ID: YH9NXOFM2
    2) IC: 9044A-NXOFM2

2.6 LIGHTING CONTROL PANELS

A. NX Lighting Control Panels
1. Basis of Design Product: NX Lighting Controls System, NX Lighting Control Panels.
2. As indicated and where shown on the plans, install NX Lighting Control Panels V2 (NXP2 Series).
3. Panel shall be a fully distributed intelligent lighting controller with the ability to function as a stand-alone lighting control panel or as part of an NX networked system.
4. Panel shall provide standard capacities for 8, 16, 24, 32, or 48 relays in each panel with matching number of 0-10v dimming channels.
5. Panel shall be available in custom configurations. Configuration options shall include: panel shipment type (enclosure/interior shipped together, enclosure/interior shipped separately, enclosure only, and interior only), panel size, number of single pole/double pole relays, emergency control option, input voltage and enclosure mount (surface mount or flush mount).
6. Panels shall be factory assembled and tested. No field assembly shall be required.
7. Construction:
    a. Panel shall be surface or flush wall mounted in a NEMA1 rated enclosure, based on panel configuration.
    b. Panel shall be capable of being shipped with enclosure/interior together, enclosure/interior separately, enclosure only, and interior only in appropriately designed packaging. When enclosure is shipped separately, enclosure shall enable rough-in of all electrical connections prior to receipt of the panel interior.
    c. Panel enclosure shall have standard electrical conduit knockouts on the top, the bottom and both sides of the enclosure to allow installation flexibility. Field drilling and cutting for pipe and wire shall not be required.
    d. Panel shall provide keyhole mounting holes in the rear of the enclosure.
    e. Panel enclosure shall include 6” spacing running the width of the panel at the bottom of the panel to allow for line voltage accessories such as contactors or to provide a “gutter”. Space shall be separated from the low voltage area utilizing a removable metal barrier. No knockouts added to the bottom plate of the inner high voltage divider. Exterior enclosure will maintain knockouts on bottom.
    f. Panel venting shall conform to NEMA 1 enclosure specifications to contain any local explosion and to protect the working environment.
    g. Panel enclosure shall feature removable metal barriers that separate all high-voltage components and wiring (Class 1) from all low-voltage (Class 2) components and wiring.
    h. Panel enclosure shall be of welded construction primed and painted with a powder coat finish. Unpainted or galvanized enclosures are not acceptable.
    i. Panel cover shall attach to the enclosure with #10-32 x ½” truss head machine screws.

j. Panel cover shall employ “keyhole” style openings for the top two mounting screws to allow the panel’s cover to be temporarily hung during installation eliminating the need to completely remove all the mounting screws along with contributing to safety ensuring the cover does not swing if all screws were removed.
   1) 8 Relay panel cover – 4 mounting holes: 2 keyhole style slots, 2 slotted style slots
   2) 16/32 Relay panel cover – 6 mounting holes: 2 keyhole style slots, 4 slotted style slots
   3) 48 Relay panel cover – 8 mounting holes: 2 keyhole style slots, 6 slotted style slots

k. Panel cover shall be sized for either surface or recess mounting of the panel.

l. Panel cover shall have hinged locking door to expose only the low voltage wiring section of the panel.

m. Panel door hinges shall be located on the left side.

n. Panel shall be provided with a factory or field installable panel interior. Panel interior shall contain all controller electronics, power supplies, relays, and other required components. Panel shall arrive at the project site completely pre-wired and requiring only the connection of lighting circuits and network cable. Systems that require field assembly of controllers or chassis inserts are not acceptable

o. Panel interior components shall reside on a framed skeleton. When disconnected from the load circuits and necessary mounting connections, the framed skeleton can be removed taking all the electrical components intact.

p. Panel interior components shall be designed to not become dislodged during shipment.

q. Panel spacing between panel relays shall be suitable for separating any two relays in the panel to meet the NEC requirements for normal and emergency power when a metal divider is installed between relays. A metal plate barrier shall be available to separate relays - two plates per application.

r. Panel relays shall be of the snap-in type and be individually field replaceable.

8. Electrical:
   a. Panel shall be supplied with either a 120V/277V, 347V or 480V power supply.
   b. Panel power supply shall provide the required capacity for the operation of the panel, relays, controllers, NX Network, SmartPORTs, user interfaces and the maximum number of low voltage and/or data devices that can be connected to each panel.
   c. Panel wire connections shall be made to labeled terminal blocks.
   d. Panel shall have LED status/failure indicators.
   e. Panel shall provide support for Bluetooth programming using the NX Lighting Controls Mobile App and the NX Bluetooth Radio Bridge with Clock or a SmartPORT connected NX sensor.
   f. Panel shall include two (2) Ethernet ports for connection to the NX Network.
   g. Panel shall include four (4) RJ45 NX SmartPORTs for the connection of all NX sensors and switches. SmartPORTs shall be capable of supplying 250 mA of Class 2 auxiliary DC power for use by wall switch stations, occupancy sensors, and daylight sensors connected to the SmartPORT connectors

h. Panel shall have four (4) 3-wire low voltage dry contact inputs. Removable terminal blocks shall be provided to support momentary or maintained closures from building automation systems, fire systems, demand response and security systems as well as other systems or devices including occupancy sensors, daylight sensors, and low voltage switches. Each input shall be individually programmable and provide the ability to initiate any NX switch compatible function or command. (on, off, raise, lower, preset, timed on/off). Each input will provide a connection for sourcing 24V, a common, control and pilot light functionality for low voltage switch stations.
i. Panel shall have two (2) SPDT (NO/NC) dry contact outputs, with removable terminal blocks, to provide a contact closure to signal out to another system that is capable of receiving a NO or NC closure to signal building automation, security or alarm system based on a schedule or a command from an input device (e.g. occupancy sensor, daylight sensor, wall switch station, etc.). Each output will have a contact rating of 24VDC@50mA minimum.
j. Panel shall have an easily accessible, removable coin size battery for maintaining system time during a power loss.
k. Panel shall, after a power loss, retain time for a minimum of 72 hours.
l. Panel time shall be updated when connected to a device utilizing the NX Lighting Controls Mobile App or from an NX network time server.
m. Panel shall feature a power sensing circuit for UL924 operation. Upon detection of loss of power, the panel shall force all relays closed and all dimming channels to full bright. Panel shall maintain this state until normal power is restored. Connected devices will not be powered.
n. Panel shall have a test button on the optional UL924 board to test the UL924 operation.
o. Panel shall have a low voltage remote test switch input on the optional UL924 to test the UL924 operation.
p. Panel shall provide relay/dimmer boards to expand panel capacity from 8 to 48 relay outputs in groups of 8. Relay/dimmer boards shall be completely self-configuring and shall not require manual settings to configure for use within the panel.
q. Panel relay/dimmer boards shall confirm relay presence and status.
r. Panel relay/dimmer boards shall have (8) 0-10V integrated dimming channels, each capable of sinking 50mA.
s. Panel dimming channels shall be software assignable.
t. Panel shall be capable of containing 1 to 48 robust and reliable mechanically latching lighting control relays as indicated on the drawings and schedules as specified herein. Electrically held or non-mechanically latching relays shall not be considered.
u. Panel relays shall be individually UL and CUL listed and shall bear labels indicating compliance. Lighting control relays shall be tested to UL standard 508 for both safety and endurances and bare labels signifying compliance.
v. Panel relays shall have the following load ratings:
    1) Single Pole Relays:
        a) General Use: 30A @ 300VAC
        b) Tungsten: 2400W @ 120VAC
        c) Standard Ballast: 20A @ 300VAC
        d) Motor Starting: 1HP @ 110-125VAC; 1½ HP @ 220-277VAC
    2) Double Pole Relays:

a) General Use: 20A @ 480VAC
b) Tungsten: 2400W @ 120VAC
c) Standard Ballast: 20A @ 480VAC
d) Motor Starting: 1HP @ 110-125VAC; 1½ HP at 220-277VAC

w. Panel relays shall be rated for minimum cycle life of 120,000+ operations (60,000+ cycles).
x. Panel relays shall have a Short Circuit Current Rating (SCCR) of 18,000A @ 277VAC.
y. Panel relays shall have a built-in manual override lever & ON/OFF indicator.
z. Panel relays shall be capable of manual activation On or Off with or without power.

9. Functional:
   a. Panel shall be of the distributed intelligence type and shall not be dependent on a network connection to execute schedules or perform programmed functions.
   b. Panel shall be programmed using the optional NXBTC Bluetooth® radio module with clock or NXBTI Bluetooth® radio module and NX Lighting Controls Mobile App. When networked, panel configurations shall be performed utilizing the NX Area Controller's web-browser based Graphical User Interface.
   c. Panel shall provide the ability to update panel firmware. Firmware update process shall ensure that the complete and correct firmware (e.g. via CRC check) has been downloaded before the panel is flashed with the new firmware.
   d. Panel set up and configuration functions shall include (but are not limited to):
      1) Assign/reassign relays for control by wall switch station buttons,
      2) Configure relays and dimmers for occupancy or vacancy operation with support for a grace period and schedule-based occupancy sensor settings based on programmed primary and secondary times,
      3) Assign/reassign dimmers to raise/lower switches,
      4) Assign dimming channels for response to daylight sensor control,
      5) Assign names to relays/dimmers,
      6) Auto calibrate default daylight sensor sequence of operation,
      7) Create and save preset scenes,
      8) Configure wall switch button types. At a minimum, button types shall include toggle on/off with pilot, preset, on only and off only,
      9) Configure up to six zones of daylight harvesting per room with independent set points and time delays,
      10) Include or exclude loads from occupancy sensor control,
      11) Configure up to 16 load groups per zone,
      12) Configure up to 16 preset scenes per zone with independent fade times,
      13) Set independent power up conditions for relays and dimmers,
      14) Set independent occupied and unoccupied conditions for each relay and dimmer,
      15) Adjust dimmer high and low trim points,
      16) Manually control lighting loads
   e. Panel shall provide the ability to create up to ninety-nine (99) schedules per zone. Each schedule will consist of the following:

1) Event Time – Shall be configured as a specific set “Normal” time (hh:mm am/pm) or as an offset based on one of the following: Before Sunrise, After Sunrise, Before Sunset, After Sunset, Before Open, After Open, Before Close or After Close.
2) Action – Task to be performed: None, Group State, or activation of a Preset.
3) None – No action to perform
4) Group State – The specific relay / dim level / color temp range settings, that the select group(s) of actuators should implement.
5) Presets – The specific preset that should be activated.

f. Panel shall provide the ability to disable a schedule
g. Panel shall provide the ability to delete a schedule

2.7 CONTROLLED RECEPTACLES

A. HCS Controlled Receptacle
1. Basis of Design Product: NX Lighting Controls System, HCSREC Series Controlled Receptacle.
2. Controlled Receptacle shall be capable of controlling other receptacles downstream in the branch circuit.
3. Controlled Receptacle shall be automatically controlled by a low voltage signal from an occupancy sensor or any other type of control capable of performing this task, e.g., time-of-day control device.
4. Controlled Receptacle shall be available in split or fully controlled 15A or 20A models.
5. Controlled Receptacle shall feature permanent NEC 406.3 (E) markings.
6. Controlled Receptacle shall be UL498B SA Listed Receptacles with integral switching that complies with Supplement SA.

2.8 SENSORS AND MODULES

A. NX Smart Sensor Module Passive Infrared, Wireless Occupancy & Daylight Sensor
1. Basis of Design Product: NX Lighting Controls System, NX Smart Sensor Modules.
2. As indicated in the specifications and as shown on the plans, install NXSMP2 series sensor module enabled fixture(s).
3. NX Smart Sensor Module shall be designed to install directly into or on the fixture housing or lens.
4. NX Smart Sensor Module shall integrate seamlessly into the NX Network.
5. NX Smart Sensor Module shall have an RF frequency of 2.4GHz.
6. NX Smart Sensor Module shall include Bluetooth and provide connection to the NX Network using the NX Lighting Controls Mobile App.
7. NX Smart Sensor Module Occupancy/Vacancy sensor shall provide automatic or vacancy switching of lighting load(s) within an area/zone based on the presence of human activity.
8. NX Smart Sensor Module Occupancy/Vacancy sensor shall be microprocessor controlled and utilize IntelliSCOPE™ technology to provide real-time graphical occupancy data.
9. NX Smart Sensor Module Occupancy/Vacancy sensor shall not require any adjustments of any kind at the time of installation or during operation.

10. NX Smart Sensor Module Occupancy/Vacancy sensor shall be powered by SmartPORT™ using plenum rated SmartPORT plug and play cables.
11. NX Smart Sensor Module Occupancy/Vacancy sensor shall have a timer that can be adjusted manually from 1 second to 20 minutes.
12. NX Smart Sensor Module Occupancy/Vacancy sensor sensitivity shall be adjustable from 1 to 10.
13. NX Smart Sensor Module Occupancy/Vacancy sensor shall include non-volatile memory for retaining device settings during power outages.
14. NX Smart Sensor Module Occupancy/Vacancy sensor shall have RED real time motion indicator LED visible from the front of the unit.
15. NX Smart Sensor Module Occupancy/Vacancy sensor may be programmed for active and inactive times.
16. NX Smart Sensor Module Occupancy/Vacancy sensor shall be available with the following 360° coverage patterns:
    a. SMI/LMI – 1:1 (mounting height to radius) up to 14 feet
    b. OMNI – 1:1.5 (mounting height to radius) up to 14 feet
    c. LMO – 1:3 (mounting height to radius) up to 16 feet
    d. HMO – 1:1.4 (mounting height to radius) up to 45 feet indoors / 32 feet outdoors
17. NX Smart Sensor Module daylight sensor shall continually measure the amount of visible light under the lighting fixture to provide continuous On/Off and full range dimming control of fixture or group under its control.
18. NX Smart Sensor Module daylight sensor shall utilize a closed loop daylight harvesting algorithm to maintain the required light level in response to changes in daylight.
19. NX Smart Sensor Module daylight sensor shall have independently programmable ramp up and ramp down times to allow the sensor to respond quickly to decrease in daylight and respond more slowly to increase in daylight to minimize the effect of sudden changes in daylight.
20. NX Smart Sensor Module daylight sensor shall be capable of being programmed for active and inactive times.
21. NX Smart Sensor Module daylight sensor shall include non-volatile memory for retaining device settings during power outages.

B. NX Smart Sensor Module Passive Infrared, Wireless Occupancy & Daylight Wall Switch Sensor
    1. Basis of Design Product: NX Lighting Controls System, NX Smart Sensor Modules.
    2. As indicated in the specifications and as shown on the plans, install NXSMP2 series sensor modules.
    3. NX Smart Sensor Module shall be designed for indoor use only and to mount directly in single-gang NEMA-style switch box (standard switch box – max mounting height: 48”).
    4. NX Smart Sensor Module shall integrate seamlessly into the NX Network.
    5. NX Smart Sensor Module shall have an RF frequency of 2.4GHz.
    6. NX Smart Sensor Module shall include Bluetooth and provide connection to the NX Network using the NX Lighting Controls Mobile App.
    7. NX Smart Sensor Module Occupancy/Vacancy sensor shall provide automatic or vacancy switching of lighting load(s) within an area/zone based on the presence of human activity.

8. NX Smart Sensor Module Occupancy/Vacancy sensor shall be microprocessor controlled and shall have Passive Infrared (PIR) detection technology.
9. NX Smart Sensor Module Occupancy/Vacancy sensor shall utilize IntelliSCOPE™ technology to enable fine-tuning of the motion detection technologies using real-time Passive Infrared (PIR) graphical occupancy data.
10. NX Smart Sensor Module Occupancy/Vacancy sensor shall be powered by SmartPORT™ using plenum rated SmartPORT plug and play cables.
11. NX Smart Sensor Module Occupancy/Vacancy sensor shall have a timer that can be adjusted manually from 1 second to 20 minutes.
12. NX Smart Sensor Module Occupancy/Vacancy sensor sensitivity shall be adjustable from 1 to 10.
13. NX Smart Sensor Module Occupancy/Vacancy sensor shall include non-volatile memory for retaining device settings during power outages.
14. NX Smart Sensor Module Occupancy/Vacancy sensor shall have a Red Passive Infrared (PIR) real time motion indicator LED visible from the front of the unit.
15. NX Smart Sensor Module Occupancy/Vacancy sensor may be programmed for active and inactive times.
16. NX Smart Sensor Module Occupancy/Vacancy sensor shall have the following coverage:
    a. Coverage: Adjustable up to 1,000 square feet
    b. Max Mounting Height: 48”
17. NX Smart Sensor Module daylight sensor shall continually measure the amount of visible light under the lighting fixture to provide continuous On/Off and full range dimming control of fixture or group under its control.
18. NX Smart Sensor Module daylight sensor shall utilize a closed loop daylight harvesting algorithm to maintain the required light level in response to changes in daylight.
19. NX Smart Sensor Module daylight sensor shall have independently programmable ramp up and ramp down times to allow the sensor to respond quickly to decrease in daylight and respond more slowly to increase in daylight to minimize the effect of sudden changes in daylight.
20. NX Smart Sensor Module daylight sensor shall include non-volatile memory for retaining device settings during power outages.
21. NX Smart Sensor Module shall have fully configurable switch type functionality.
22. NX Smart Sensor Module shall have a programmable lightbar with multiple modes: Location Indicator, Group Status, and Occupancy.
23. NX Smart Sensor Module shall be available in White, Black, Gray, Ivory, Light Almond and Red colors.

C. NX Smart Sensor Module Dual Technology, Wireless Occupancy & Daylight Wall Switch Sensor
    1. Basis of Design Product: NX Lighting Controls System, NX Smart Sensor Modules.
    2. As indicated in the specifications and as shown on the plans, install NXSMDT series sensor modules.
    3. NX Smart Sensor Module DT shall be designed for indoor use only and to mount directly in single-gang NEMA-style switch box (standard switch box – max mounting height: 48”).
    4. NX Smart Sensor Module DT shall integrate seamlessly into the NX Network.
    5. NX Smart Sensor Module DT shall have an RF frequency of 2.4GHz.

6. NX Smart Sensor Module shall include Bluetooth and provide connection to the NX Network using the NX Lighting Controls Mobile App.
7. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall provide automatic or vacancy switching of lighting load(s) within an area/zone based on the presence of human activity.
8. NX Smart Sensor Module Occupancy/Vacancy sensor shall be microprocessor controlled and shall have adjustable technology detection modes including Dual Technology (Passive Infrared (PIR) and Ultrasonic (US)), Passive Infrared (PIR) only, and Ultrasonic (US) only.
9. NX Smart Sensor Module Occupancy/Vacancy sensor shall utilize IntelliSCOPE™ technology to enable fine-tuning of the motion detection technologies using real-time Passive Infrared (PIR) and Ultrasonic (US) graphical occupancy data.
10. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall be powered by SmartPORT™ using plenum rated SmartPORT plug and play cables.
11. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall have a timer that can be adjusted manually from 1 second to 20 minutes.
12. NX Smart Sensor Module DT Occupancy/Vacancy sensor sensitivity shall be adjustable from 1 to 10.
13. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall include non-volatile memory for retaining device settings during power outages.
14. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall have a Red Passive Infrared (PIR) and Green Ultrasonic (US) real time motion indicator LEDs visible from the front of the unit.
15. NX Smart Sensor Module DT Occupancy/Vacancy sensor may be programmed for active and inactive times.
16. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall have the following coverage:
    a. Coverage: Adjustable up to 1,000 square feet
    b. Max Mounting Height: 48”
17. NX Smart Sensor Module DT daylight sensor shall continually measure the amount of visible light under the lighting fixture to provide continuous On/Off and full range dimming control of fixture or group under its control.
18. NX Smart Sensor Module DT daylight sensor shall utilize a closed loop daylight harvesting algorithm to maintain the required light level in response to changes in daylight.
19. NX Smart Sensor Module DT daylight sensor shall have independently programmable ramp up and ramp down times to allow the sensor to respond quickly to decrease in daylight and respond more slowly to increase in daylight to minimize the effect of sudden changes in daylight.
20. NX Smart Sensor Module DT daylight sensor shall include non-volatile memory for retaining device settings during power outages.
21. NX Smart Sensor Module DT shall have fully configurable switch type functionality.
22. NX Smart Sensor Module DT shall have a programmable lightbar with multiple modes: Location Indicator, Group Status, and Occupancy.
23. NX Smart Sensor Module DT shall be available in White, Black, Gray, Ivory, Light Almond and Red colors.

D. NX Smart Sensor Module Dual Technology, Wireless Occupancy & Daylight Ceiling Mount Sensor
    1. Basis of Design Product: NX Lighting Controls System, NX Smart Sensor Modules.

2. As indicated in the specifications and as shown on the plans, install NXSMDT series sensor modules.
3. NX Smart Sensor Module DT shall be designed for indoor use only and to mount directly to ceilings.
4. NX Smart Sensor Module DT shall integrate seamlessly into the NX Network.
5. NX Smart Sensor Module DT shall have an RF frequency of 2.4GHz.
6. NX Smart Sensor Module shall include Bluetooth and provide connection to the NX Network using the NX Lighting Controls Mobile App.
7. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall provide automatic or vacancy switching of lighting load(s) within an area/zone based on the presence of human activity.
8. NX Smart Sensor Module Occupancy/Vacancy sensor shall be microprocessor controlled and shall have adjustable technology detection modes including Dual Technology (Passive Infrared (PIR) and Ultrasonic (US)), Passive Infrared (PIR) only, and Ultrasonic (US) only.
9. NX Smart Sensor Module Occupancy/Vacancy sensor shall utilize IntelliSCOPE™ technology to enable fine-tuning of the motion detection technologies using real-time Passive Infrared (PIR) and Ultrasonic (US) graphical occupancy data.
10. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall be powered by SmartPORT™ using plenum rated SmartPORT plug and play cables.
11. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall have a timer that can be adjusted manually from 1 second to 20 minutes.
12. NX Smart Sensor Module DT Occupancy/Vacancy sensor sensitivity shall be adjustable from 1 to 10.
13. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall include non-volatile memory for retaining device settings during power outages.
14. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall have a Red Passive Infrared (PIR) and Green Ultrasonic (US) real time motion indicator LEDs visible from the front of the unit.
15. NX Smart Sensor Module DT Occupancy/Vacancy sensor may be programmed for active and inactive times.
16. NX Smart Sensor Module DT Occupancy/Vacancy sensor shall have the following coverage:
    a. 1:2.75 Coverage pattern (mounting height to coverage radius)
    b. Coverage: Adjustable up to 2,000 square feet
    c. Recommended Mounting Height: 8ft (2.44m) with a max mounting height: 12ft (3.66m)
17. NX Smart Sensor Module DT daylight sensor shall continually measure the amount of visible light under the lighting fixture to provide continuous On/Off and full range dimming control of fixture or group under its control.
18. NX Smart Sensor Module DT daylight sensor shall utilize a closed loop daylight harvesting algorithm to maintain the required light level in response to changes in daylight.
19. NX Smart Sensor Module DT daylight sensor shall have independently programmable ramp up and ramp down times to allow the sensor to respond quickly to decrease in daylight and respond more slowly to increase in daylight to minimize the effect of sudden changes in daylight.
20. NX Smart Sensor Module DT daylight sensor shall include non-volatile memory for retaining device settings during power outages.
21. NX Smart Sensor Module DT shall be available in White, Black and Gray colors.

E. NX Occupancy Sensors, Wired
   1. Basis of Design Product: NX Lighting Controls System, NX Occupancy Sensors.
   2. NX Occupancy Sensors shall be ceiling or wall mounted and use dual technology (ultrasonic and passive infrared), ultrasonic and/or passive infrared (model specific) sensing technology as indicated.
   3. NX Occupancy Sensors shall be Class 2 and connect to any room controller SmartPORT using a wiring adaptor and standard Cat5 patch cable.
   4. NX Occupancy Sensors shall be microprocessor controlled and utilize IntelliDAPT® technology to optimize sensor behavior to adapt to space conditions and occupant usage patterns and adjust sensitivity and time delay to maximize energy savings and minimize false On and Off events
   5. NX Occupancy Sensors shall be self-adaptive and not require manual calibration after installation. Digital circuitry and logic shall automatically adjust the sensitivity and time delay based on learned occupancy patterns and the environment in which the sensor is installed.
   6. NX Occupancy Sensors using both ultrasonic and passive infrared (dual technology) shall operate such that detection by both technologies is required to initiate occupancy and continued detection by either technology will maintain occupancy.
   7. Up to four NX Occupancy Sensors may be connected to one room controller.

F. NX Occupancy Output Interface
   1. Basis of Design Product: NX Lighting Controls System, NXRO Series Occupancy Output Interface Module.
   2. NX Occupancy Output Interface shall communicate the occupancy state of an NX control zone to HVAC or other building systems using a contact closure.
   3. NX Occupancy Output Interface shall connect to a SmartPORT™ and provide the aggregate occupancy state of the zone as reported by one or more occupancy sensors.
   4. NX Occupancy Output Interface shall mount to a standard 4 11/16” junction box.
   5. NX Occupancy Output Interface shall have a removable terminal block for input connection.
   6. NX Occupancy Output Interface shall be powered by NX SmartPORT.
   7. NX Occupancy Output Interface shall support multiple occupancy sensors in a zone.
   8. NX Occupancy Output Interface shall feature a low voltage Form-C relay for Normally Closed / Normally Open operation.
   9. NX Occupancy Output Interface shall be a low voltage device: 24VDC.

G. NX Daylight Sensor, Wired
   1. Basis of Design Product: NX Lighting Controls System, NXDS Series Daylight Sensor.
   2. NX Daylight Sensor shall provide ambient light level information to the room controller allowing daylight responsive lighting control.
   3. The system shall operate in an open loop sequence of operation reducing the amount of electric light as the quantity of daylight entering the room increases.
   4. It shall be possible to configure up to six daylight zones in a room. Each zone shall be programmable to proportionally respond to the light level provided by the daylight sensor.

5. NX Daylight Sensor shall be mounted vertically or horizontally and positioned to provide an unobstructed view of the windows per the manufacturer's directions.
6. NX Daylight Sensor shall be available in indoor and outdoor models.
7. NX Daylight Sensor shall have an architecturally attractive design.
8. NX Daylight Sensor shall have a foot-candle range: 3-6,000FC

H. NX Wall Partition Sensor
1. Basis of Design Product: NX Lighting Controls System, NXWPS Series Wall Partition Sensor.
2. NX Wall Partition Sensor shall automatically signal the NX Lighting Controls System when a moveable partition has been opened or closed. This allows the two adjacent rooms to be combined or separated into individual rooms.
    a. NX controls shall automatically reconfigure to operate in unison when rooms are combined.
    b. NX controls shall automatically reconfigure to operate independently when the rooms are separated.
    c. NX system shall allow for room combine scenarios with up to 16 combinable rooms.
3. NX Wall Partition Sensor shall be a low voltage device: 24VDC.

I. NX Dry Contact Closure Interface
1. Basis of Design Product: NX Lighting Controls System, NXCI Series Contact Closure Interface.
2. NX Dry Contact Closure Interface shall enable third-party devices to provide dry contact inputs to the NX Lighting Controls System.
3. NX Dry Contact Closure Interface shall provide switch activation using contact closures from external devices such as key switches, AV systems, photo-eye sensors or other low voltage Class 2 devices.
4. NX Dry Contact Closure Interface shall default to On/Off operation and can be programmed to perform alternate functions including:
    a. Toggle On/Off
    b. Preset
    c. Raise
    d. Lower
    e. Timed On
5. NX Dry Contact Closure Interface shall feature a removable terminal block for input connection.
6. NX Dry Contact Closure Interface shall feature pilot light output terminals.
7. NX Dry Contact Closure Interface shall be a low voltage device: 24VDC.

J. NX Dry Contact Output Module
1. Basis of Design Product: NX Lighting Controls System, NXDCO Series Dry Contact Output Module.
2. NX Dry Contact Output Module shall provide a low voltage dry contact interface for the control of third-party devices and systems such as HVAC, shades/draperies, as well as other non-NX Lighting or other control systems.
3. NX Dry Contact Output Module shall connect to an NX FX or SP (SmartPORT) port.
4. NX Dry Contact Output Module shall feature a low voltage Form C relay that supports normally closed (NC) or normally open (NO) operation.

5. NX Dry Contact Output Module shall feature a removable terminal block for output connection.
6. NX Dry Contact Output Module shall support two different mode options:
   a. Relay Mode
   b. Dimming (0-10V/CCT) Mode
7. NX Dry Contact Output Module shall include an integral timeclock to run scheduled events.
8. NX Dry Contact Output Module shall be constructed as follows:
   a. Housing: Rugged injection molded plastic, PC-FR UL 94-5VA flame class rating
   b. UL2043 Plenum Rated
   c. Color: Blue
   d. Weight: 1.59oz (45g)
   e. Dimensions: 0.98” (24.89mm) H x 1.53” (38.86mm) W x 2.61 » (66.29mm) D
9. NX Dry Contact Output Module shall include multiple mounting options:
   a. DIN Rail Mount
   b. Direct Screw Mount
   c. Single Tie Wrap
10. NX Dry Contact Output Module shall have the following electrical ratings:
    a. Input:
       1) Input Voltage: 12-24VDC supplied by FX or SmartPORT Bus
       2) Power Consumption: 24mA (3 NX PBUs)
    b. Output:
       1) Max 500mA @ 24VDC/VAC Load (Relay Mode)
       2) Max 50mA Sink Current (0-10VDC/CCT Mode)
11. NX Dry Contact Output Module shall support the following operating environments:
    a. Indoor use only
    b. Operating Temperature: 32° to 104°F (0°C to +40°C)
    c. Relative Humidity (non-condensing) 0% to 90%
12. NX Dry Contact Output Module shall be configured for one of the following operating modes:
    a. Relay Mode
       1) Maintained On/Off
       2) Momentary (with configurable pulse duration): 500-60,000ms (0.5 to 60 seconds) in 100ms steps
    b. Dimming Mode
       1) 0-10VDC Dimming with Dim to Off Shunt
       2) 0-10VDC CCT Control
13. NX Dry Contact Output Module shall provide a momentary pushbutton with a blue LED to facilitate test and manual override of the control module. Functions of the button/LED are as follows:
    a. Relay Mode – Single momentary press:
       1) Device will turn relay On/Off
       2) LED will turn On for On, and Off for Off
       3) If button is held for 10+ seconds, device will factory reset and blink once
    b. Dimming Mode – Maintained press (10 seconds)
       1) Device will turn On and raise 0-10VDC level to 100%

2) LED will blink On/Off while raising dimming level, and will stay On when at 100%
3) Repeat maintained press to lower dimming level back down to 0%
   a) Device will remain in this state until the button is depressed for 10 seconds, which will return it to normal operation
   b) If device is left untouched for 5min or has experienced a power cycle, the device will return to normal operation
4) If button is held for more than 10 seconds, device will factory reset and blink once

2.9 WALL STATIONS

A. NX SimpleTouch™ Graphic Wall Station
1. Basis of Design Product: NX Lighting Controls System, NX SimpleTouch Graphic Wall Station.
2. Graphic Wall Station shall employ a 3.5” resistive LCD-TFT, full-color touch screen with 320x480 screen resolution in portrait orientation.
3. Graphic Wall Station shall mount to a standard single gang switch box.
4. Graphic Wall Station shall utilize standard Cat5 cabling for connection to system SmartPORT. Provide two RJ45 ports to allow daisy chain connection with other NX Smart Switches.
5. Graphic Wall Station shall operate seamlessly with other NX Smart Switches.
6. Graphic Wall Station shall provide a 4GB microSD card for storing user preferences that include the quantity of controls per screen, function names, screen navigation, home screen selection, and custom screen saver graphic image.
7. Graphic Wall Station screens can be configured to meet project requirements for control of up to 16 groups, each with provision for On/Off and dimming, up to 16 preset scenes, or CCT color control.
8. Graphic Wall Station shall be capable of local control within a single space or configured for master control across spaces or building wide.
9. Graphic Wall Station shall have an optional password access control that will require a secure PIN to access the station.
10. Graphic Wall Station shall have adjustable screensaver timeout and backlight brightness.
11. Graphic Wall Station shall be supplied with a white bezel. Optional color change kit shall allow for Ivory, Grey, Light Almond, or Black.

B. NX Smart Wall Stations (Low Voltage)
1. Basis of Design Product: NX Lighting Controls System, NXSW2 Series Smart Wall Stations (Low Voltage).
2. NX Smart Wall Stations (Low Voltage) shall be of the programmable type using standard Cat5 cabling for connection to system SmartPORT™.
3. NX Smart Wall Stations (Low Voltage) shall have one, two, three, four, five, six or eight buttons and provide lighting control functions as called out and shown on the plans. Momentary and Maintained digital Key switch versions shall also be available.
4. NX Smart Wall Stations (Low Voltage) shall be available with the following specialty versions:
   a. OO: On/Off

b. ORLO: On/Raise/Lower/Off
c. RL: Raise/Lower
d. TO: Timed-On
e. SS: Scene

5. Construction:
   a. Housing: Rugged, high impact, injection molded plastic
   b. Mounting: Wall Stations shall be capable of being mounted to single-gang and multi-gang wall boxes and shall be compatible with standard decorator style wall plates.
6. Electrical:
   a. Class 2 Low Voltage 24VDC
   b. Connection via two (2) RJ-45 SmartPORTs to allow for daisy chain connection of up to eight Wall Stations to each SmartPORT.
7. NX Smart Wall Stations (Low Voltage) shall be available in White, Ivory, Light Almond, Gray, Black, and Red.

C. NX Smart Wall Stations (Wireless – Battery Powered)
1. Basis of Design Product: NX Lighting Controls System, NXSW Series Smart Wall Stations (Wireless-BP).
2. NX Smart Wall Stations (Wireless-BP) shall be of the programmable type using the NX Lighting Controls Mobile App.
3. NX Smart Wall Stations (Wireless-BP) shall have a single rocker switch with two momentary switches and provide lighting control functions as called out and shown on the plans.
4. NX Smart Wall Stations (Wireless-BP) shall be programmable with the following switch functions:
   a. On/Off
   b. On/Raise
   c. Off/Lower
   d. Raise
   e. Lower
   f. Timed-On
   g. Scene
5. Construction:
   a. Housing: Rugged, high impact, injection molded plastic
   b. Mounting: Wall Stations shall be capable of being mounted directly to wall surfaces using provided 3M Command™ Strip, and to single-gang and multi-gang wall boxes and shall be compatible with standard decorator style wall plates (not included).
   c. Wall Stations shall include a built-in level to ensure device is mounted properly.
6. Electrical:
   a. Class 2 Low Voltage 24VDC
   b. 3VDC, 5.4mA
   c. Powered using CR2032 battery only
7. NX Smart Wall Stations (Wireless-BP) shall be available in White.

D. NX Smart Wall Stations (Wireless – AC Powered)
1. Basis of Design Product: NX Lighting Controls System, NXSW2-W Series Smart Wall Stations (Wireless-AC).

2. NX Smart Wall Stations (Wireless-AC) shall be powered by 120/277VAC.
3. NX Smart Wall Stations (Wireless-AC) shall be programmable using the NX Lighting Controls Mobile App and NX Site Manager.
4. NX Smart Wall Stations (Wireless-AC) shall have one, two, three, four, five, six or eight buttons and provide lighting control functions as called out and shown on the plans.
5. NX Smart Wall Stations (Wireless-AC) shall be gang-able with other decorator-type devices.
6. NX Smart Wall Stations (Wireless-AC) shall be digitally addressable.
7. NX Smart Wall Stations (Wireless-AC) shall support switch specific Color Packs.
8. NX Smart Wall Stations (Wireless-AC) shall be available with the following specialty versions:
    a. WOO: Wireless On/Off
    b. WORLO: Wireless On/Raise/Lower/Off
    c. WSS: Wireless Scene Switch
    d. WCCT: Wireless Color Control Switch
9. Construction:
    a. Housing: Rugged, high impact, injection molded plastic, Polylac FR-ABS, (UL-94 5VA) flame class rating
    b. Color:
        1) Stations available in White, standard
        2) Black, Gray, Ivory, Light Almond, Red available through field installable Color Packs
    c. Weight: 4.8oz (136g)
    d. Housing Dimensions: 4.12” L (104.65mm) x 1.86” W (47.24mm) x 1.72” D (43.4mm)
10. Mounting:
    a. Single-gang NEMA-style switch box (standard switch box – max mounting height: 48”)
    b. Multi-gang switch box supported via standard NEMA-style electrical box
    c. Decorator-style wall plate sold separately
11. Electrical:
    a. Input Voltage: 120/277VAC
    b. Power Consumption: 34mA
12. Programming Interface:
    a. NX Lighting Controls Mobile App
    b. NX Site Manager (NXAC2-120-SM) for Network Applications
13. Operating Environment:
    a. Rated for Indoor Use Only
    b. Operating Temperature: 32° to 104°F (0° to 40°C)
    c. Relative Humidity (Non-Condensing): 0 to 95%
14. Wireless:
    a. 2.4GHz; IEEE 802.15.4 based
    b. Bluetooth Version 5.2 (Range: Up to 50ft clear line of sight)
    c. Radio Range: ~300ft (91m) Note: Range Based on Clear Line of Sight
    d. Recommended Deployment Practice: Locate at least three (3) radios within a 300ft radius for most reliable performance
15. Certifications:
    a. cULus Listed
    b. Complies with FCC Part 15

E. NX Audio Visual Interface Module
1. Basis of Design Product: NX Lighting Controls System, NXAVM Series Audio Visual Interface Module.
2. NX Audio Visual Interface Module shall enable third-party systems to digitally interface with an NX Lighting Controls System.
3. NX Audio Visual Interface Module shall provide an ASCII based command set to interface with third-party systems such as Audio-Visual systems to send commands to and receive query status from an NX system.
4. NX Audio Visual Interface Module shall feature a DB9 connector and support RS232 serial communication, providing control and status for a single zone.
5. NX Audio Visual Interface Module shall mount to a standard 4 11/16" junction box.

2.10 NETWORK AREA CONTROLLER

A. NX Area Controller
1. Basis of Design Product: NX Lighting Controls System, NX Area Controller V2 (NXAC2 Series).
2. NX Area Controller shall connect to the NX Network providing communication with the NX Room Controllers, NX Lighting Control Panels, NX SmartPORT™ Modules and other wired NX system components.
3. NX Area Controller shall have the ability to communicate by means of TCP/IP over Ethernet allowing enterprise connectivity between the NX Lighting Controls System and external LAN or WAN networks.
4. NX Area Controller shall be capable of communicating with Building Automation System via an embedded BACnet™ client using the BACnet IP protocol.
5. NX Area Controller shall enable the connection of multiple users simultaneously.
6. NX Area Controller shall enable secure remote connections over a cellular network.
7. NX Area Controller shall have a physical modem switch that can turn off remote cellular and Wi-Fi radios.
8. NX Area Controller shall feature user account/password management.
9. Construction:
    a. Design: Solid State – No moving parts
    b. 7.32" W x 2.6" H x 4.9" D (186mm x 66mm x 126mm)
    c. 2.9 LB (1.21 KG)
    d. Mounting: Wall or DIN rail mounting
    e. Housing Color: Black
10. Electrical:
    a. 100-240VAC, 50/60 Hz (AC Adapter included)
    b. Ethernet 10 base-T via NX Network cable, integral 2-port ethernet hub.
11. Functional:
    a. NX Area Controller shall function as a web server allowing the user interface to be accessible through a standard web browser.
    b. The installation of software shall not be required. At a minimum, the user interface shall provide the following functions:
        1) Automatic discovery of NX system devices
        2) Commissioning of devices into logical Areas and Zones, provide a minimum of 128 areas each with 128 zones
        3) Display the entire system in a logical navigation tree view

4) Allow the user to name Zones, Groups, Presets, Schedules and individual loads
5) Set up control functions for system inputs and outputs
6) Monitor status and override individual relays and dimmers
7) Set up and download schedules to panels and room controllers
8) Monitor real-time power use at each room controller

2.11 NETWORK MODULES

A. NX Network Bridge Module
1. Basis of Design Product: NX Lighting Controls System, NX Network Bridge Module.
2. NX Network Bridge Module shall allow multiple room controller zones to be networked with other NX system devices for whole building administration of lighting control functions.
3. NX Network Bridge Module housing shall measure 5.75" X 3.85" X 1.3"and be constructed of GSM UL rated 94 HB plastic approved for use in a return air plenum.
4. NX Network Bridge Module shall connect to and be powered from a room controller SmartPORT via a standard Cat5 cable.
5. NX Network Bridge Module shall provide RJ-45 ports for in and out connection points for an Ethernet based network.
6. NX Network Bridge Module shall provide a communication link between the room control devices and the NX system Area Controller via an Ethernet based network. At a minimum, the network link shall provide the following functionality through a web browser user interface:
   a. Report the current occupancy status for each lighting control zone
   b. Indicate the status of each relay and dimming channel
   c. Allow reconfiguration of system device input and output parameters
   d. Report the real time power consumption for each Room Controller
   e. Set up daylight harvesting for zones equipped with photocells
   f. Configure and download schedules to panels and Room Controllers

B. NX Network Radio Module
1. Basis of Design Product: NX Lighting Controls System, NXRM2 Series Radio Module.
2. NX Network Radio Module shall allow a luminaire equipped with the NXFM In-Fixture Module to be promoted wirelessly from standalone operation to full network participation.
3. NX Network Radio Module shall plug into the SmartPORT™ connector on the NXFM In-Fixture Module and is mounted through a 1.25” aperture in the luminaire housing.
4. NX Network Radio Module shall feature a low-profile housing for minimal visual impact.
5. NX Network Radio Module shall feature an O-ring gasket to provide watertight seal to luminaire housing.
6. NX Network Radio Module shall have an integrated and compact PCB F antenna and shall not require an external antenna.
7. NX Network Radio Module shall integrate seamlessly into the NX Network.
8. NX Network Radio Module shall have an RF frequency of 2.4GHz.

9. NX Network Radio Module shall include Bluetooth and provide connection to the NX Network using the NX Lighting Controls Mobile App.

2.12 NETWORK ACCESSORIES

A. NX Bluetooth® Radio Bridge
1. Basis of Design Product: NX Lighting Controls System, NXBTI Series Bluetooth Radio Controller.
2. NX Bluetooth Radio Bridge shall provide a wireless communication bridge for communications via iOS® or Android™ smart device apps.
3. NX Bluetooth Radio Bridge shall connect to and be powered by an NX SmartPORT™.
4. NX Bluetooth Radio Bridge shall use Bluetooth technology allowing the radio to easily pair with a smart phone or tablet.
5. NX Bluetooth Radio Bridge shall communicate with the NX system for setup and control from a smart device.
6. NX Bluetooth Radio Bridge shall feature 8mb of storage for storing NX device firmware files.
7. NX Bluetooth Radio Bridge shall be capable of updating device firmware for all connected wired devices in a Zone.
8. NX Bluetooth Radio Bridge shall provide password protections for user access preventing unauthorized Bluetooth connection of a smart device.
9. NX Bluetooth Radio Bridge shall use Bluetooth Version 4.1 or greater.
10. NX Bluetooth Radio Bridge shall feature an LED status indicator for successful connections.
11. NX Bluetooth Radio Bridge shall have a RJ45 plug-in connection to NX SmartPORT.
12. NX Bluetooth Radio Bridge shall be a low voltage 24VDC device.
13. NX Bluetooth Radio Bridge shall be rated for return air plenum.

B. NX Media Converter
1. Basis of Design Product: NX Lighting Controls System, NXEOF Series Media Converter.
2. NX Media Converter shall allow a transition from copper based ethernet to fiber.
3. NX Media Converter shall support 10BASE-T, 100BASE-TX, 100BASE-FX and IEEE 802.3 specifications.
4. NX Media Converter shall be a multimode converter and support up to 5km distance.
5. NX Media Converter shall include an RJ45 port that supports full/half-duplex auto-negotiation and MDI/MDIX auto-crossover.
6. NX Media Converter shall include LED indicators for RJ45 and fiber port status.
7. NX Media Converter shall include a wall mounting kit.

C. NX Network PoE Switch
1. Basis of Design Product: NX Lighting Controls System, NXPOE Series PoE Switch/Power Injector.
2. NX Network PoE Switch shall provide the splitting of the NX Network from the NX Area Controller into multiple segments.
3. NX Network PoE Switch shall provide seven powered RJ45 ports for connection of NX network devices.

4. NX Network PoE Switch shall provide multiple dimming options including DMX to less than 0.1%.
5. NX Network PoE Switch shall expand the capacity of the NX Area Controller to 448 bridges suitable for large commercial and architectural interiors.

D. NX Forward and Reverse Phase Dimming Converter
1. Basis of Design Product: NX Lighting Controls System, NX Forward and Reverse Phase Dimmer Converter.
2. NX Forward and Reverse Phase Dimmer shall auto-sense forward and reverse phase dimming.
3. NX Forward and Reverse Phase Dimmer shall dim standard 120V or 277V lighting loads.
4. NX Forward and Reverse Phase Dimmer shall support up to 1300W max load.
5. NX Forward and Reverse Phase Dimmer shall provide dual 0-10V input and output ports.
6. NX Forward and Reverse Phase Dimmer shall provide an integrated 6.5ft flexible conduit.
7. NX Forward and Reverse Phase Dimmer shall be compatible with NX Room Controllers, NX Lighting Control Panels and Low Voltage Dimming Switches.
8. Construction:
   a. Housing: Anodized aluminum
   b. Size: 4.01” L x 5.52” W x 1.88” H
   c. Complies with requirements for use in a plenum area
   d. Mounting: Surface mount with screws
9. Electrical:
   a. Input: 120/277VAC, 60Hz – Single feed input connection
   b. Output: 120/277VAC, 60Hz – Single feed output connection
   c. Low Voltage: Class 2, 0-10V Input and output
   d. Max Load Rating:
      1) 120VAC: 700W
      2) 277VAC – 1300W
   e. Min Load Rating: 24W
   f. Standby Power:
      1) 120VAC: 0.75W
      2) 277VAC: 1.87W
   g. Dimming:
      1) Class 2 / Class 1 (NOTE: Installation as Class 1 requires 600 volt insulation on dimming conductors sharing a conduit with line voltage conductors)

2.13 SOFTWARE INTERFACES

A. NX Site Manager:
1. NX Site Manager shall serve as a primary graphical user interface for the networked lighting system, providing communication with lighting control panels, room controllers, fixture modules, and other wired system components and through wireless access point to wireless room controllers and fixture modules.
2. NX Site Manager shall be accessible via conventional PC/Tablet web browser through the Site Manager’s built-in web server.

3. NX Site Manager shall enable users to program, monitor, and administer the NX Lighting Controls System from any location without additional software.
4. NX Site Manager shall enable users to configure general client information including client name, address, phone, email and a custom image.
5. NX Site Manager shall enable users to select from a list of standard United States holidays and to configure custom holidays.
6. NX Site Manager shall enable users to create one or more buildings and configure building information include building name, address, latitude/longitude, phone, electricity cost per kilowatt, custom image, hours of operation and open/close times.
7. NX Site Manager shall enable users to import license files to unlock separately licensable features of Site Manager.
8. NX Site Manager shall enable users to reset forgotten passwords based on a set of password-reset questions.
9. NX Site Manager shall enable system administrators to configure an interactive user session timeout
10. NX Site Manager shall enable system administrators to select a self-signed or trusted certificate security mode and specify domain name, certificate, certificate key and certificate chain.
11. NX Site Manager shall enable system administrators to create user roles (e.g., system admin, facility manager, general user), specify role permissions, and assign areas of responsibility. Role permissions shall be configurable for application management, client management, device management and building operation and shall include the ability to edit, view-only, or none.
12. NX Site Manager shall enable system administrators to perform user management tasks including adding users, assigning roles & permissions, activating & locking user accounts, and deleting user accounts. NX Site Manger shall support Active Directory users.
13. NX Site Manager shall enable users to modify their user profile information including name, email, phone, address, password, and password-reset security questions.
14. NX Site Manager shall enable users to configure NX Site Manager Adapters which manage the NX Network. Each NX Site Manager Server shall include an embedded Site Manager Adapter. Adding additional NX Site Manager Adapter devices to the NX Network provides the ability to expand the NX Network. Each NX Site Manager Adapter will be assigned to a specific Site Manager building and will communicate with the Site Manager Server over an IP (Ethernet) network.
15. NX Site Manager shall enable users to configure system settings including network IP information, general data management, software updates, log files, scheduled jobs, and diagnostics.
16. NX Site Manager shall include an embedded BACnet IP client that is field configurable, enabling integration of the NX Lighting Controls System and a building automation system.
17. NX Site Manager shall enable users to discover networked devices, devices by MAC address or all devices for each Site Manager Adapter. Discovered devices shall appear in a tree showing the physical connections of devices.
18. NX Site Manager shall enable users to create up to 128 Areas and 128 Zones per Area.
19. NX Site Manager shall enable users to assign devices to Zones by dragging and dropping the selected device into a zone, or by using the drop-down selection tool.

20. NX Site Manager shall enable users to create up to 16 Groups per Zone. Users shall be able to assign/select devices for each group and test the group by turning the group on/off and adjusting the dimmer and CCT levels.
21. NX Site Manager shall enable users to create up to 16 Presets per Zone. Users shall be able to include/exclude actuators, configure actuator settings and test the preset by activating it.
22. NX Site Manager shall enable users to create up to 99 Schedules per Zone. Users shall be able to name each schedule, specify the schedule type and occurrence, and specify the action that will take place for the selected group or preset. NX Site Manager shall also enable the user to assign a color to the schedule.
23. NX Site Manager shall enable users to select a device and configure that device's general information and device settings.
24. NX Site Manager shall enable users to configure actuators (e.g., relays and dimmers) for occupancy or vacancy operation with support for grace period occupancy levels, schedule-based occupancy levels based on programmed primary and secondary times, and companion zone occupancy levels based on the occupancy state of adjacent Zone(s).
25. NX Site Manager shall enable users to configure NX digital photosensors for two-zone daylight harvesting applications.
26. NX Site Manager shall enable users to copy a device's settings, wink a device, resync a device, swap devices, specify active/inactive times, and decommission devices.
27. NX Site Manager shall enable users to create multiple and single device-type settings profiles for actuators (e.g. relays, dimmers and CCT dimmers) and apply/clone profile settings to multiple Zone(s).
28. NX Site Manager shall enable users to generate custom reports with selectable and filterable report headings and export (.csv) the following reports:
    a. Zone Summary
    b. Device Summary
    c. CCT Summary
    d. Dimmer Summary
    e. In-Fixture Module Summary
    f. Occupancy Sensor Summary
    g. Photocell Sensor Summary
    h. Relay Summary
    i. Switch Station Summary
    j. Power Input
    k. Firmware
    l. Device Schedule Summary
    m. BACnet Objects Summary
29. NX Site Manager shall enable users to perform firmware updates by device type.
30. NX Site Manager shall enable users to define up to 10 Demand Response levels per Zone. Users shall be able to select a Demand Response level and configure all actuator types to the same demand response setting or specify individual actuator demand response settings.
31. NX Site Manager shall enable users to configure emergency override device settings.
32. NX Site Manager shall enable users to view/modify Zone schedules. All Zone schedules shall be displayed in an easy-to-use calendar that supports multiple viewing modes including by day, week or work week. Users shall be able to select

and modify a schedule by selecting the Zone in the navigational tree or by selecting the schedule from the calendar.

33. NX Site Manager shall enable users to create/view/modify Zone Schedule Profiles and clone schedules to multiple Zones.
34. NX Site Manager shall support multiple system alarm types: Communication failure with devices and Site Manager Adapters, low Site Manager hardware memory and storage space.
35. NX Site Manager shall enable users to view the history of alarms and system events based on a date range.
36. NX Site Manager shall enable user to configure alarm email notification preferences.
37. NX Site Manager shall enable users to add a floor plan image to an Area. Image file types supported shall include .SVG, .JPG, .PNG, and .PDF. Max image size supported shall be 10MB.
38. NX Site Manager shall have an optional floor plan module to enable users to select a Zone and draw the selected zone's boundaries on the floor plan image. Zones that have floor plan zone boundaries created shall display an indicator next to the Zone name.
39. NX Site Manager's optional floor plan module shall enable users to modify/delete the floor plan zone boundaries.
40. NX Site Manager's optional floor plan module shall enable users to zoom in / zoom out the floor plan image.
41. NX Site Manager's optional floor plan module shall enable users to select a zone on the floor plan image and have the Zone name selected and highlighted in the navigational tree. Users shall also be able to select a Zone name in the navigational tree and have the zone selected and highlighted on the floor plan image.
42. NX Site Manager's optional floor plan module shall enable users to delete a floor plan image assigned to an Area.
43. NX Site Manager's optional floor plan module shall have an operational mode for users to view the status of Zones on a floor plan image. Status information shall be color coded and include on/off states and occupied/unoccupied states. Zones with no occupancy sensors shall be identified as having "No Occupancy Sensors".
44. NX Site Manager's optional floor plan module shall enable users to control a zone by selecting a Zone from the navigational tree or from the floor plan image. Once selected, the Zone Controller window shall appear enabling the user to turn the Zone on/off, change light and/or color tuning levels for all groups within the Zone or specific groups. The Zone Controller window shall also enable users to see the occupancy status of the Zone and the schedules associated with the Zone.
45. NX Site Manager shall have an optional energy dashboard module to enable users to view a site's energy usage and cost in an easy to read dashboard. Users shall be able to see energy usage for selected areas and zones. NX Site Manager shall enable users to select a daily, weekly, monthly, yearly or custom date range view of the energy data. Users shall be able to hover over the graphs to view actual data values and view data over a specific date range. NX Site Manager shall enable users to export energy data to a .CSV (Comma Separated Variable) file.
46. NX Site Manager shall have an optional space utilization module that can provide insights into how spaces are being utilized within a facility. NX Site Manager shall graphically view space utilization data on floor plans or charts. A playback mode shall be available to display recorded data over multiple timelines.

47. NX Site Manager shall come pre-loaded with all NX device firmware.
48. NX Site Manager shall provide troubleshooting tools to enable users to:
    a. Compare device schedules
    b. Check communication health between Site Manager and Site Manager Adapters
    c. Detect wired and wireless network loops
    d. View and manage firmware update status
    e. View and manage device discovery activity
49. NX Site Manager shall support secure REST APIs for third-party application integration.
50. NX Site Manager shall support English and French languages.

B. NX Lighting Controls Mobile App
1. NX Lighting Controls Mobile App shall provide Bluetooth® wireless setup and configuration of NX system devices and luminaires equipped with an NX In-Fixture Module and smart sensor.
2. NX Lighting Controls Mobile App shall be available in Android and iOS versions for free download from Google Play™ or Apple® App Store.
3. NX Lighting Controls Mobile App shall connect to NX devices via NXBTC/NXBTI modules, NXSMP/NXSMP2/NXSMDT/SXSMIR sensors and radio modules via Bluetooth BLE.
4. NX Lighting Controls Mobile App shall enable easy setup and configuration of NX room devices and NX panels.
5. NX Lighting Controls Mobile App shall enable users to configure actuators (e.g., relays and dimmers) for occupancy or vacancy operation with support for grace period occupancy levels, schedule-based occupancy levels based on programmed primary and secondary times, and companion zone occupancy levels based on the occupancy state of adjacent Zone(s).
6. NX Lighting Controls Mobile App shall enable users to configure NX digital photosensors for two-zone daylight harvesting applications.
7. NX Lighting Controls Mobile App shall enable users to create custom schedules and presets.
8. NX Lighting Controls Mobile App shall be able to configure SpectraSync™ or SpectraClean™ enabled luminaires.
9. NX Lighting Controls Mobile App shall globally discover wireless enabled luminaires and devices.
10. NX Lighting Controls Mobile App shall include the IntelliSCOPE™ visual diagnostic tool for real-time calibration and testing of NX digital smart occupancy sensors.
11. NX Lighting Controls Mobile App shall come pre-loaded with all NX device firmware files.
12. NX Lighting Controls Mobile App shall control lighting zone groups from the Bluetooth device discovery page.
13. NX Lighting Controls Mobile App shall provide device filtering options and maintain filtering selections across device discovery refreshes.
14. NX Lighting Controls Mobile App shall provide labeling on devices to quickly identify a device’s function.
15. NX Lighting Controls Mobile App shall display Sunrise/Sunset times based on longitude/latitude coordinates.
16. NX Lighting Controls Mobile App shall enable users to view connected devices by device type from the Bluetooth device discovery page.

17. NX Lighting Controls Mobile App shall provide a button to quickly clear text fields.
18. NX Lighting Controls Mobile App shall support English and Spanish languages.

2.14 CONDUCTORS AND CABLING

A. Power Supply Side of Remote-Control Power Sources: Comply with network manufacturer's requirements and requirements of Division 26 Section "Low-Voltage Electrical Power Conductors."

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Prior to installation, contractor shall examine work area to verify measurements, all wire type and routing requirements, and that commencing installation complies with manufacturer's requirements.

B. Where variations from the general specifications or drawings exist, the contractor shall request a clarification prior to rough in or installation

3.2 INSTALLATION

A. Lighting controls shall be installed in accordance with manufacturer’s instructions, guidelines and submittal documents provided by the lighting control manufacturer.

B. Lighting control system components shall only be installed in spaces that meet the following environmental conditions:

1. Temperature: 32 – 104 deg F (0 - 40 deg C).
2. Relative Humidity: 10 – 90 percent, noncondensing.

C. All stored and installed lighting control system components shall be adequately protected from dust and dirt.

3.3 SYSTEM STARTUP

A. The system manufacturer shall provide a factory authorized field engineer to the project site after installation has been completed and prior to system energization for the purpose of testing and adjustment of the system.

B. Factory field engineer shall test and verify all system functions and ensure proper operation of the system components in accordance with the specifications and on-site conditions. The installing contractor shall notify the system manufacturer in writing that the system is completely wired and ready to be energized and tested 2 weeks prior to scheduling a field engineer for start-up of the system. Should the field engineer arrive on the job site and find the installation incomplete, the installing contractor shall pay the cost of any future visits by the field engineer required to complete the system start-up.

C. Factory field engineer shall provide a written report of test and outcomes.

3.4 DEMONSTRATION AND TRAINING

A. Factory field engineer shall instruct the owner's staff on how to adjust, operate and maintain lighting systems; and provide instructions using the system software.
   1. Allow for up to 4 hours of on-site training on the use and maintenance of the lighting control system to be scheduled at the completion of startup and programming of the system.

3.5 TECHNICAL SUPPORT

A. Manufacturer shall provide reasonable access to the factory direct telephone technical support during normal business hours.

END OF SECTION 26 09 43

SECTION 26 24 00 - ELECTRICAL DISTRIBUTION EQUIPMENT

1. GENERAL

   A. All electrical distribution equipment shall be dead front UL listed for the purpose and application. All equipment shall meet or exceed all applicable requirements of the National Electrical Code (N.E.C.). Any device or component, i.e., switchboard, panel, breaker, switch, etc., used as service entrance equipment, shall be listed for use at 100% of the rated capacity.

2. MAIN SWITCHBOARD - CIRCUIT BREAKER STYLE

   A. Switchboard shall be dead front, totally enclosed, free standing or wall mounted, as required or herein specified, housing the equipment as indicated. The switchboard shall meet Underwriters' Laboratories enclosure requirements, and be furnished with an Underwriters' Laboratories label. The entire switchboard is to be Square D I-Line or equivalent construction, G.E., Siemens, Eaton / Cutler - Hammer or approved equivalent. Where switchboards are floor-mounted, provide concrete housekeeping pad, 3" high, with #4 rebar on 6" X 6" centers, per A.C.I. standards. Chamfer edges of pad 1/2".

   B. The switchboard shall be dead-front with front accessibility. The switchboard framework shall consist of steel channels bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. The framework is to be formed of code gauge steel, rigidly welded together to support all cover plate, bussing and component devices. All unused positions shall have closures.

   C. Each switchboard section shall have an open bottom (closed for wall-mounted style) and a top plate for installation and termination of conduit. Top and bottom conduit areas are to be clearly shown and dimensioned on the shop drawings. The wireway front covers shall be secured by screws and hinged, to permit access to the branch circuit breaker load side terminals. The paint finish shall be medium light gray, per ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment. Enclosure shall be NEMA 1, with drip shield on top. Provide top covers without knockouts. All conduit entries to be field cut. At top conduit entries, provide weatherproof sealing lock nuts on terminator.

   D. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 on temperature rise. Main and/or through busses shall be 100% annealed copper. The through bus shall have an ampacity in amperes as indicated on the drawings and shall be braced to have a short circuit current rating of 100,000 RMS symmetrical amperes unless otherwise indicated. (Where through bus is provided, it shall have provisions for the addition of future sections on the branch or distribution side.) The through bus supports, connections and joints are to be bolted with hex head bolts and Belleville washers to minimize maintenance requirements.

E. Neutral bussing shall be of the same ampacity bussing and insulated from the enclosure. Ground bussing shall be sized and shall be bonded to the enclosure per N.E.C., current edition. Service grounding electrode connection shall be made between ground and neutral busses. Provide ground bushings and equipment ground conductor connection on each feeder conduit leaving switchboard and at the terminal end for each continuous metallic feeder conduit.

F. Each switchboard, as a complete unit, shall be given a single short circuit current rating by the manufacturer. Such a rating shall be established by actual tests by the manufacturer, in accordance with UL specifications, on equipment constructed similarly to the subject switchboard.

G. The service disconnect device(s) shall be thermal-magnetic molded case circuit breaker(s) installed totally front accessible and front connectable, unless otherwise noted on the contract documents. Line side of branch circuit breaker connections are to be jaw type plug-on.

H. Group mounted molded case circuit breakers for branch distribution are to be totally front accessible. These circuit breakers are to be mounted in the switchboard to permit installation, maintenance and testing without reaching over any line side bussing. All line and load side connections are to be individual to each circuit breaker. Common mounting brackets or electrical bus connectors will not be acceptable. Line side circuit breaker connections are to be jaw type plug-on, arranged to withstand the anticipated fault currents.

I. Each circuit breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate as well as exercise the circuit breaker operating mechanisms.

J. Include kw, kwh, voltage, amperage metering per phase along with appropriate digital output to interface with campus DDC control system for remote monitoring of power system. Coordinate with controls supplier for a 100% complete installation.

K. Provide an arc energy reducing maintenance switch with local status indicator for all breakers or equipment rated or adjustable to 1,200 Amps or greater. Provide a local status indicator light for all breakers equipped with maintenance switches. Maintenance switch and indicator shall be mounted to the breaker face or immediately adjacent to the breaker in the switchboard enclosure. Maintenance switch shall have permanently mounted lockout/tagout provisions. Provide labelling to indicate operation instructions for maintenance switch at each switch.

L. All circuit breakers shall have a minimum ISCA rating of 65,000 amps, A.I.C., unless otherwise noted on the One-Line Diagram.

M. Arc Flash Hazard warning labels shall be affixed to all switchboards in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually-

operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.

N. Switchboard shall be Square "D" (Schneider Electric), G.E., Siemens, Eaton/Cutler–Hammer or approved equivalent.

O. Lockable breakers shall be provided for all breakers serving all HVAC equipment, Plumbing equipment, and kitchen appliances.

3. DISTRIBUTION PANELBOARDS (600 AMPERE OR GREATER)

A. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge steel, with gray baked enamel finish electrodeposited over cleaned, phosphatized steel.

B. The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers. Bus structure shall be full height of panel.

C. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50ºC. rise above ambient. Heat rise tests shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All panelboards unless otherwise noted shall have space to accept forty-two 20 amp one pole circuit breakers.

D. All circuit breakers and distribution panel bussing shall have a minimum ISCA rating of 22,000 amps, A.I.C., unless otherwise noted on the One-Line Diagram. **All circuit breakers shall be fully rated for the symmetrical A.I.C. rating of the panelboard in which they are installed. Series rating of breakers is not allowed.**

E. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between "ON" and "OFF." Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. All panelboards shall be capable of accepting 225 amp 3 pole branch breakers as a minimum unless otherwise noted.

F. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on schedules on the plans or as

determined by verification with local utility company. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

G. Arc Flash Hazard warning labels shall be affixed to all panelboards in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.

H. Provide energy reducing maintenance switch with local status indicator for any breaker or equipment rated or adjustable to 1,200 Amps or greater.

I. Distribution panelboards shall be Square "D", G.E., Siemens, Eaton/Cutler–Hammer or approved equivalent.

J. Lockable breakers shall be provided for all breakers serving all HVAC equipment, Plumbing equipment, and kitchen appliances.

4. BRANCH PANELBOARDS

A. This section covers lighting and power panelboards (refer to schedules, notes on Drawings and the Electrical One-Line Diagram, of the Contract Drawings).

B. All panelboards shall be of the circuit breaker type and shall be of one manufacturer.

C. Branch panelboards shall be as indicated on the drawings and as specified herein. The lighting panelboards shall be of the dead-front, quick-make, quick-break, plug-in circuit breaker type, with trip indicating and trip free handles. All circuits shall be clearly and properly numbered and shall be provided with thermal magnetic protection. The panelboards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and heavy chrome locks. Locks shall all be keyed alike. Each door shall have a directory card inside, covered with a plastic shield, filled in with black India ink or typewritten with circuit numbers and description indicated. Room numbers shall be coordinated with final room numbers as selected by Owner -- not numbers on Contract Documents.

Special Note: The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme, unless the Contractor is directed to do so by the Architect or Engineer.

D. Branch panelboards shall be surface or flush mounted as indicated on the Contract Documents.

E. Circuit breakers for 120/208 volt systems shall be of 10,000 A.I.C. RMS symmetrical rating unless otherwise indicated on the Contract Drawings. **All circuit breakers shall be fully rated for the symmetrical A.I.C. rating of the panelboard in which they are installed. Series rating of breakers is not allowed.**

F. All main bus and connections thereto in branch panelboards shall be copper. All bus bars shall extend full length of panelboards.

G. All circuit breakers used to switch lights shall be SWD (switching duty) rated and U.L. listed for the purpose.

H. Where required by the National Electrical Code, provide branch arc-fault circuit interrupters (A.F.C.I.'s) in branch panelboards, whether indicated on the panel schedule or not. They shall be U.L. listed, latest edition.

I. Where branch circuit breakers feed hermetically, sealed compressor for cooling or refrigeration equipment, provide U.L. listed H.A.C.R.-style circuit breakers.

J. Where branch circuit breakers are indicated or required to be ground-fault circuit-interrupting type (G.F.C.I.), they shall have test and reset buttons and be U.L. listed, latest edition. Do not share neutrals with other circuits.

K. Where branch circuit breakers are feeding H.I.D. (high-intensity-discharge) loads, they shall be rated and listed for such loads. Provide proper circuit breaker whether indicated on panel schedules or not.

L. Arc Flash Hazard warning labels shall be affixed to all panelboards in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.

M. Panels shall be Square "D", G.E., Siemens, Eaton/Cutler-Hammer or approved equivalent.

N. Lockable breakers shall be provided for all breakers serving all HVAC equipment, Plumbing equipment, and kitchen appliances.

5. INSTALLATION INSTRUCTIONS

A. Panelboards with circuit breakers installed before the building has been finished and cleaned shall be masked.

B. All dust and debris shall be removed from the panels before they are energized and placed in service.

C. All panelboard fronts shall be omitted until final punch list inspection is made. Directories for each panelboard shall be completed and available for review by the Engineer at that time.

D. All service equipment shall be marked with the maximum available fault current and the date of the calculation. This information shall be obtained in writing from the serving utility. Provide label adjacent to the service disconnecting means. Document action of the fault current shall be included in the operation and maintenance manual. This labeling shall be provided for all new service installations, service upgrades, and any project that adds or replaces distribution panels or branch panel boards.

E. Where applicable - Provide a warning sign on the service entrance equipment indicating type and location of all on-site emergency power sources in accordance with the NEC.

F. Where applicable – Provide warning sign(s) for alternative power devices (photovoltaic, wind, fuel cell, etc.) on all equipment in accordance with the NEC.

G. All emergency system switchgear, distribution panels and branch panelboards shall be provided with surge protection devices in accordance with the NEC. Refer to Section 264313 Surge Suppression Systems.

6. SAFETY SWITCHES

A. Provide heavy duty safety switches as a final disconnecting means as required by NEC and/or as indicated on the Contract Drawings.

B. All safety switches shall be NEMA Type 1, NEMA 3R, NEMA 4 stainless steel, NEMA 12, or as required by the operating environment, Heavy Duty Type HD, UL listed.

C. All safety switches shall have switch blades that are fully visible in the "OFF" (open) position with the door open.

D. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.

E. Switch mechanism shall be quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.

F. Arc Flash Hazard warning labels shall be affixed to all switches in accordance with Article 110.16 of the National Electrical Code. All components protected by a manually operated arc energy reduction means shall have an additional label affixed that describes the location of the energy reduction means.

G. Switches shall be as manufactured by Square D., G.E., Siemens, Eaton/Cutler-Hammer or approved equivalent.

7. FUSES

A. Upon completion of the building, the Contractor shall provide the owner with spare fuses as shown below. All fuses shall be Bussmann, Shawmut, Gould or Reliance.

(1) 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares:

(2) Bussmann spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

B. No fuses shall be installed in the equipment until the installation is complete, including tests and inspections required prior to being energized. All fuses shall be of the same manufacturer to ensure retention of selective coordination, as designed.

C. Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN HI-CAP TIME DELAY FUSES KRP-C. Fuses shall employ "O" rings as positive seals between the end bells and the fuse barrel. Fuses shall be a time-delay type and must hold 500% of rated current for a minimum of 5 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes R.M.S. symmetrical. The fuses shall be UL Class L.

D. Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses, LPN-RK (250 volts) or LPS-RK (600 volts). All dual element fuses shall have separate overload and short circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284°F melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of l0 seconds and be listed by Underwriters Laboratories, Inc. with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK1.

E. Motor Circuits - All individual motor circuits rated 480 amperes or less shall be protected by BUSSMANN LOW PEAK DUAL-ELEMENT FUSES LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in rating approximately l25% of motor full load current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the Type KRP-C HI-CAP Time Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in rating approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.

F. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual Element fuses LPN-RK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

8. CONTACTORS

A. General

(1) Contactors shall be continuously rated at the specified amperes per pole for all types of ballast and tungsten lighting, resistance and motor load. Contactors shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts will not be acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring. Contactors shall have straight-through wiring with all terminals clearly marked. Contactors shall have a gasketed NEMA Type 1 (NEMA 12 for electrically held) enclosure, unless otherwise noted or required.

(2) Contactors shall be approved per UL 508 and/or CSA and be designed in accordance with NEMA Standards. They shall be industrial duty rated for applications to 600 volts maximum. I.E.C.-style contactors are not acceptable.

(3) Contactors shall have provisions for factory or field addition of:

a. Four N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.

b. Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.

c. Control-circuit fuse holder, one or two fuses.

d. 0.2-60 second adjustable interval timer attachment, if so indicated on plans.

e. Transient-suppression module for coil control circuit. Coil control to be 120 volts. Provide circuit or step-down transformer.

B. Electrically Held Lighting Contactors

(1) Contactor coils shall be continuously rated and encapsulated, 120 volt rated. Enclosures shall be NEMA 12, to minimize noise transmission.

C. Mechanically Held Lighting Contactors

(1) Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. Coils shall be rated for 120 volt operation.

(2) Lighting contactors shall be Square D Class 8903 or equivalent by G.E., Siemens, Eaton/Cutler-Hammer or Allen-Bradley.

END OF SECTION 26 24 00

SECTION 26 27 26 - WIRING DEVICES AND PLATES

1. GENERAL

   A. This section of the specifications includes wiring devices, cover plates, weatherproof and dust-tight closures, communications devices and floor outlets.

   B. Wiring devices are listed by manufacturer and catalog numbers to establish the quality and type required. Equivalent devices of other manufacturers will be acceptable with prior approval of the Engineer. Submit cutsheets and/or samples of each type ten days prior to bid date for review and written approval to bid. Insofar as possible, standard application or special application devices shall be by one manufacturer.

2. MATERIALS

TYPE	RATING	CONFIGURATION	COLOR	VENDOR - CAT. #
RECEPTACLE - DUPLEX COMMERCIAL GRADE	125V, 20A	NEMA 5-20R		HUBBELL CR5362 GE 5362 LEVITON 5362
RECEPTACLE - DUPLEX G.F.I. (SHALL MEET U.L. 943 STANDARD)	125V, 20A	NEMA 5-20R		HUBBELL GFR5352A
RECEPTACLE - SIMPLEX	125V, 20A	NEMA 5-20R		HUBBELL 5361
RECEPTACLE, DUPLEX ISOLATED GROUND (WITH ORANGE LEGEND PLATE)	125V, 20A	NEMA 5-20R	ORANGE	HUBBELL IG-5362 GE 5362-IG LEVITON 5362-IG
RECEPTACLE, DUPLEX HOSPITAL GRADE (TO BE USED IN ALL PATIENT CARE AREAS, PER N.E.C., ART. 517)	125V, 20A	NEMA 5-15R NEMA 5-20R		HUBBELL 8200H GE 8200 LEVITON 8200 HUBBELL 8200H GE 8300 LEVITON 8300
	125V, 15A	NEMA 5-15R		HUBBELL 5250S

RECEPTACLE, DUPLEX ISOLATED GROUND WITH SURGE SUPPRESSION, INCLUDING INDICATOR LIGHT			BLUE DEVICE	LEVITON 5380 ARROW-HART 5362
SWITCH, SINGLE POLE	120/277V, 20A	SPST		HUBBELL HBL-1221 GE 5951 LEVITON 1221
SWITCH, THREE-WAY	120/277V, 20A	3-WAY		HUBBELL HBL-1223 GE 5953 LEVITON 5953
SWITCH, FOUR-WAY	120/277V, 20A	4-WAY		HUBBELL HBL-1224 GE 5954 LEVITON 5954

NOTE:

SWITCH, KEYED TO EACH BE FURNISHED WITH ONE HUBBELL #1209 KEY. TURN OVER TO OWNER AT CLOSE OF PROJECT AND OBTAIN RECEIPT FOR VERIFICATION THAT KEYS HAVE BEEN DELIVERED.

NOTES:

1. PROVIDE MATCHING CAP (PLUG) FOR ALL RECEPTACLES 30 AMP RATED AND ABOVE AS REQUIRED FOR EQUIPMENT.

2. ALL RECEPTACLES SHALL BE BACK OR SIDE-WIRED, CLAMPING TYPE

3. FOR DRYERS AND RANGES, PROVIDE 3-POLE GROUNDING TYPE AS REQUIRED BY DEVICE. LOCATE DEVICE SO THAT DRYER OR RANGE CAN BE PUSHED TIGHTLY AGAINST WALL.

4. RECEPTACLES SHALL BE TAMPER RESISTANT AND WEATHER RESISTANT AND MARKED ACCORDINGLY AS REQUIRED BY N.E.C.

! SEE ARTICLE 3, COLOR.

A. Small Motor Control Switches:

(1) For small line-to-neutral motor loads of 3/4 HP or less, single phase, rated at 120 or 277 volts, provide snap-type, H.P. rated motor starter switch with thermal overloads. Overload heaters sized to match the motor nameplate amperes and the ambient temperature shall be provided. Provide with NEMA 1, NEMA 3R or other enclosure suitable for the location and atmosphere. All manual starters in finished areas shall be in flush-mounted enclosures.

3. COLOR

A. Color of devices shall be as selected by the architect. Samples (devices, plates or both) may be required to be submitted with other architectural color items by the Contractor. The Contractor shall coordinate any such submission required with other trades, the Prime Contractor or as needed.

B. Where devices are controlling or supplying emergency power from a standby source, the device color shall be red, as with switch toggles or receptacle fronts. Plate color shall match others on normal power in the building unless otherwise noted.

C. Where surface finishes next to the devices vary in color or shade throughout the project, the Contractor may be required to provide lighter or darker plates and devices to more closely match wall finishes. These variations are considered to be included in the original contract for construction.

4. PLATES AND COVERS

A. Unless otherwise specified or noted, all wiring device plates and covers shall be brushed finish 302 stainless steel.

B. Cover plates shall be of one manufacturer insofar as possible.

C. Weatherproof plates for G.F.C.I. receptacles shall be cast aluminum, self-closing, gasketed, suitable for standard box mounting, U.L. listed for wet location use, cover closed. Vertical mounting - Hubbell WP26M, horizontal mounting - Hubbell WP26MH (die-cast zinc) or equivalent Leviton or G.E.

D. Weatherproof switch plates for toggle-handle switches shall be clear silicone rubber, for standard outlet boxes. Hubbell 1795 or equivalent G.E. or Leviton.

E. Cover plates for computer, telephone or other system outlets shall be as required to meet supplier or the owner's requirements, as applicable. Color to match other plates on project. Furnish telephone plates with wall-mounting studs if mounted at 48" or higher. Refer to Division 27.

5. INSTALLATION

A. All wiring devices in dusty areas, exposed to weather and moisture shall be installed in Type "FS" or similar conduit fittings having mounting hubs, with appropriate cover plates.

B. Devices that have been installed before painting shall be masked. No plates or covers shall be installed until all finishing and cleaning has been completed.

C. Provide G.F.C.I. duplex feed-thru style receptacles in accordance with new U.L. Standard 943 where indicated or required by the National Electrical Code, whether specifically called out or not. When a G.F.C.I. receptacle is on a circuit with other non-G.F.C.I. receptacles, it shall always be placed at the homerun point of the circuit and shall be wired to ground-fault interrupt protect the downstream outlets on that circuit unless specifically indicated to the contrary. Provide a "G.F.C.I. protected" label on each downstream outlet.

D. Where surge suppression outlets are provided, they shall be ANSI Category "A" style. They shall be installed as dedicated-circuit outlets or where indicated with multiple outlets on a circuit, they shall be placed at the homerun point of that circuit and feed-thru wired to protect the downstream outlets on that circuit.

E. All receptacles shall be installed with ground prong at top position.

F. All outlets not provided with wiring devices shall be closed with a blank plate matching other plates in the area.

G. Receptacles installed in waiting rooms, hallways, and other public-accessible spaces shall all be of the tamper-resistant type in addition to other types and features of device.

END OF SECTION 26 27 26

SECTION 26 32 13 - NATURAL GAS EMERGENCY GENERATOR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Engine.
2. Gas fuel system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Load bank.
7. Outdoor generator-set enclosure.
8. Vibration isolation devices.

B. Related Requirements:

1. Section 26 36 00 "Automatic Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.2 DEFINITIONS

A. EPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. LP: Liquefied petroleum.

D. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.

4. Include fuel consumption in cubic feet per hour (cubic meters per hour) at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor, with air supply temperature of 95 deg F (35 deg C), 80 deg F (27 deg C), 70 deg F (21 deg C), and 50 deg F (10 deg C). Provide drawings indicating requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams indicating terminal markings for EPS equipment and functional relationship between all electrical components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and a qualified testing agency.

B. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails, identify center of gravity and total weight, supplied enclosure, silencer (external or internal), and each piece of equipment not integral to the engine generator, and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Report of factory test on units to be shipped for this Project, indicating evidence of compliance with specified requirements.

4. Report of sound generation.
5. Report of exhaust emissions indicating compliance with applicable regulations.
6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

D. Field quality-control reports.

E. Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For engine generators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
b. Operating instructions laminated and mounted adjacent to generator location.
c. Training plan.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Tools: Each tool listed by part number in operations and maintenance manual.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Current certificate holder for compliance with ISO 9001.

B. Installer Qualifications: An authorized representative who is trained and approved by the manufacturer.

C. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Generac Power Systems, Inc.; SG series or comparable product by one of the following:

1. Caterpillar, Inc.; Electric Power Division.
2. Cummins Power Generation.
3. Kohler Co. Manufacturing Company.
4. Engineer and Owner approved alternates.

B. Source Limitations: Obtain packaged engine generators and auxiliary components through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Engine generator housing, engine generator, batteries, battery racks, silencers, load banks, and sound attenuating equipment, accessories, and components to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.
2. Shake-table testing shall comply with ICC-ES AC156. Testing shall be performed with all fluids at worst-case normal levels.
3. Component Importance Factor: 1.0.

B. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 1 EPSS.

C. UL Compliance: Comply with UL 2200.

D. Engine Exhaust Emissions: Comply with EPA requirements and applicable state and local government requirements.

E. Noise Emission: Comply with adopted applicable state and local government requirements for maximum noise level at adjacent building locations (on the same property) due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation. The sound attenuation level for the generator enclosure shall be reviewed by the owner for compliance with university standards.

F. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: -10 to 108 deg F (Minus 24 to plus 42 deg C).
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 ft. (300 m).

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and use.

C. Power Rating: Life safety and standby.

D. Service Load: 230kW.

E. Power Factor: 0.8, lagging.

F. Frequency: 60 Hz.

G. Voltage: 480Y/277VV AC.

H. Phase: Three-phase, four wire, delta.

I. Induction Method: Naturally aspirated.

J. Governor: Adjustable isochronous, with speed sensing.

K. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

L. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of components.

M. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3.5 percent for single harmonics. Telephone influence factor, determined in accordance with NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time:

    a. Comply with NFPA 110, emergency power system requirements.
    b. 10 seconds.

2.4 GAS ENGINE

A. Fuel: Natural gas.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: Engine or skid-mounted.

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.

2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with UL 499 and with NFPA 110 requirements for Level 1 equipment for heater capacity.

E. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gauge glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Maximum Ambient Operating Temperature: 108 deg F (42 deg C).
6. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.

    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and non-collapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer:

1. Sound level measured at a distance of 23 ft. (7 m) from exhaust discharge after installation is complete shall be 70 dBA or less, not accounting for exterior generator enclosure and screening. Sound level measured for generator testing shall be tested based solely on the manufacturer's generator enclosure.

G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.

4. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 A minimum continuous rating.
7. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:

    a. Charging Rate: Automatic 10-A, dual rate float/equalize with reverse polarity protection.
    b. Charging current output measured by generator controller to support remote monitoring and diagnostics.
    c. Factory installed on engine-generator. Due to voltage drop concerns, transfer-switch-mounted battery chargers are not acceptable.
    d. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 GAS FUEL SYSTEM

A. Natural Gas Piping: Comply with requirements in Section 201300 “Pipes."

B. Gas Train: Comply with NFPA 37.

C. Engine Fuel System:

D. Natural Gas, Vapor-Withdrawal System:

1. Carburetor.
2. Secondary Gas Regulators: One for each fuel type, with atmospheric vents piped to building exterior.
3. Fuel-Shutoff Solenoid Valves: NRTL-listed, normally closed, safety shutoff valves; one for each fuel source.
4. Fuel Filters: One for each fuel type.
5. Manual Fuel Shutoff Valves: One for each fuel type.
6. Flexible Fuel Connectors: Minimum one for each fuel connection.
7. LP gas flow adjusting valve.
8. Fuel change gas pressure switch.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates generator-set shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.
   1. Generator system shall be capable of a minimum of three (3) steps of loading for various system types. Load types connected to the generator are as follows:
      a. Emergency systems, per NEC Article 700 (life-safety & egress loads, building fire pump, fire alarm system, etc.)
      b. Legally required standby systems, per NEC Article 701 (shelter in place, notification systems, etc.)
      c. Optional standby systems, per NEC Article 702 (owner desired loads, etc.).
   2. The selected generator manufacturer shall determine the step configuration that results in the smallest generator size to adequately handle all serviced loads, and shall comply with all sections of NFPA 70, NFPA 101, and NFPA 110 (and associated requirements).

B. Fully integrated microprocessor-based control system specifically designed for standby emergency engine generators, meeting all requirements of NFPA 110, Level 1 EPSS.

C. Fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions, including engine protection, alternator protection, speed governing, voltage regulation, synchronizing, load-sharing (real and reactive), and all related generator operations. The generator controller must also provide seamless digital integration with the engine's electronic engine control module (ECM) if so equipped.

D. Control panel shall comply with UL 6200.

E. Connectivity: Native Ethernet, WiFi, and Bluetooth connectivity.

F. Web Browser Interface: All user interaction accomplished via standard web browser interface. Solutions requiring dedicated software for connectivity are not acceptable.

G. Remote Connectivity: User interface available both internally and externally to the user's network, based on network security preferences. All remote connectivity may be disabled at any time by the user.

H. Automated Notification: Controller capable of sending multiple automated e-mail and SMS alerts without intermediate service provider.

I. Notification Customization: User configurable allowing any operational or fault condition to initiate notification to any personnel including (but not limited to) generator service provider.

J. Environmentally Hardened Design: Open circuit boards, edge cards, and PC ribbon cable connections are unacceptable.

K. Circuit boards with surface-mounted components to provide vibration durability. Circuit boards utilizing large capacitors or heat sinks must utilize encapsulation methods to securely support these components.

L. Configuration:

1. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine generator battery.

M. Control and Monitoring Panel:

1. Digital controller with integrated touch screen, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Instruments: Located on the control and monitoring panel and viewable during operation.

    a. Engine lubricating-oil pressure gauge.
    b. Engine-coolant temperature gauge.
    c. DC voltmeter (alternator battery charging).
    d. Running-time meter.

    e. AC voltmeter, for each phase.
    f. AC ammeter, for each phase.
    g. AC frequency meter.
    h. Generator-voltage adjusting feature.

3. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication, including the following:

    a. Cranking control equipment.
    b. Run-Off-Auto switch.
    c. Control switch not in automatic position alarm.
    d. Overcrank alarm.
    e. Overcrank shutdown device.
    f. Low water temperature alarm.
    g. High engine temperature prealarm.
    h. High engine temperature.
    i. High engine temperature shutdown device.
    j. Overspeed alarm.
    k. Overspeed shutdown device.
    l. Coolant low-level alarm.
    m. Coolant low-level shutdown device.
    n. Coolant high-temperature pre-alarm.

o. Coolant high-temperature alarm.
p. Coolant low-temperature alarm.
q. Coolant high-temperature shutdown device.
r. EPS supplying load indicator.
s. Battery high-voltage alarm.
t. Low cranking voltage alarm.
u. Battery-charger malfunction alarm.
v. Battery low-voltage alarm.
w. Lamp test.
x. Contacts for local and remote common alarm.
y. Hours of operation.
z. Engine generator metering, including voltage, current, Hz, kW, kVA, and power factor.
aa. Generator overcurrent protective device not closed alarm.

N. Engine Generator Metering: Shall comply with metering requirements per section 262400 – “Electrical Distribution Equipment”.

O. Connection to Datalink:

1. A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication.
2. Provide connections for datalink transmission of indications to remote data terminals via ModBus & BACNet. At minimum, remote indication shall be provided to the generator remote annunciator panel, the building fire alarm system, and the building automation/communication system (BAS).

P. Common Remote Panel with Common Audible Alarm: Include necessary contacts and terminals in control and monitoring panel. Remote panel powered from the engine generator battery.

Q. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.
2. Coolant low-temperature alarm.
3. High engine temperature prealarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low coolant level alarm.
8. Low cranking voltage alarm.
9. Contacts for local and remote common alarm.
10. Audible-alarm silencing switch.
11. Air shutdown damper when used.
12. Run-Off-Auto switch.

13. Control switch not in automatic position alarm.
14. Fuel tank derangement alarm.
15. Fuel tank high-level shutdown of fuel supply alarm.
16. Lamp test.
17. Low cranking voltage alarm.
18. Generator overcurrent protective device not closed.

R. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Shall be provided with a properly labeled, clear acrylic cover, and a red mushroom head. Push button shall be protected from accidental operation.

S. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.

1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.
3. The generator shall be capable of providing a minimum of two (2) output circuit breakers of varying frame sizing, up to and including 600A.

B. Generator Overcurrent Protective Device:

1. Generator shall be capable of the mounting of a minimum of (3) output overcurrent devices.

2. Molded-case circuit breaker, thermal-magnetic type; 100 percent rated; complying with UL 489:

   a. Tripping Characteristic: Designed specifically for generator protection.
   b. Trip Rating: Matched to generator output rating.
   c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
   d. Mounting: Adjacent to or integrated with control and monitoring panel.

3. Molded-case circuit breaker, electronic-trip type; 100 percent rated; complying with UL 489:

   a. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
   b. Trip Settings: Selected to coordinate with generator thermal damage curve.

c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
d. Mounting: Adjacent to or integrated with control and monitoring panel.

4. Insulated-case circuit breaker, electronic-trip type; 100 percent rated; complying with UL 489:

a. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
b. Trip Settings: Selected to coordinate with generator thermal damage curve.
c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
d. Mounting: Adjacent to, or integrated with control and monitoring panel.

5. Molded-case type disconnect switch, 100 percent rated:

a. Trip Rating: Matched to generator output rating.
b. Shunt Trip: Connected to trip switch when signaled by generator protector or by other protective devices.

C. Generator Protector: Integrated controller base unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms. Contacts shall be available for load shed functions.
2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

D. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.

1. Indicate ground fault with other engine generator alarm indications.
2. Trip generator protective device on ground fault.

E. Arc Energy Reduction: Comply with NFPA 70 for arc energy reduction for circuit breakers 1200A and greater.

1. Energy reducing maintenance switch with local status indicator.
2. Instantaneous override that is less than the available arcing current.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide six lead alternator.

E. Range: Provide limited range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Standard weatherproof enclosure. Sound attenuation to be confirmed with the owner prior to ordering of genset.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.

1. Voltage Adjustment on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
2. Maintain voltage within 15 percent on one step.
3. Provide anti-hunt provision to stabilize voltage.
4. Maintain frequency within 10 percent and stabilize at rated frequency within 5 seconds.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

L. Subtransient Reactance: 15 percent, maximum based on the rating of the engine generator set.

2.9 OUTDOOR GENERATOR-SET ENCLOSURE

A. Generator packaged within fully sealed weatherproof enclosure. Sound attenuating enclosure shall be confirmed by the owner, and provided as follows, if required:

B. Sound Insulation: Enclosure and air discharge hood completely lined with 3 inches (76 mm) of fiberglass and perforated aluminum. The enclosure shall meet the requirements, at minimum, of Level 2 sound attenuation (63 to 70 d(B)A).

C. Enclosure Construction: Minimum 14 gauge aluminum with hinged, removable doors to allow access to the engine, alternator, and control panel. Adjustable hinges to allow for door alignment. Hinges and all exposed fasteners must be stainless steel. Pop-rivets weaken the paint system and are not allowed on external painted surfaces. Each door will be equipped with lockable hardware and identical keys.

D. Upward discharging enclosure ventilation exhaust hood with silencer.

E. Enclosure Finish: Electrostatic applied powered paint, baked and finished to manufacturer's specifications.

F. Enclosure Color: Color to be factory standard finish, and confirmed by the owner.

G. Silencer mounted on top of enclosure, or integral to unit.

H. Thermostatically controlled space heater factory installed within enclosure designed to maintain minimum internal temperature at 40 deg F (4 deg C).

I. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
3. Ventilation: Provide temperature-controlled exhaust fan interlocked to prevent operation when engine is running.

J. Interior Lights with Switch: Factory-wired, vapor-proof fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.

1. AC lighting system and connection point for operation when remote source is available.
2. DC lighting system for operation when remote source and generator are both unavailable.

K. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.10 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene separated by steel shims.
2. Shore "A" Scale Durometer Rating: 70.
3. Number of Layers: One

B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch-(6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Minimum Deflection: 1 inch (25 mm)

C. Comply with requirements in Section 232116 "Hydronic Piping Specialties" for vibration isolation and flexible connector materials for steel piping.

D. Comply with requirements in Section 233113 "Metal Ducts" for vibration isolation and flexible connector materials for exhaust shroud and ductwork.

E. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

B. Powder Coated Paint Surfaces:

1. Minimum Paint Thickness: 2.5 mil (0.06 mm) in accordance with ASTM D1186-87.
2. Material Hardness: ASTM D3363-92a.
3. Resistance to Cracking: ASTM D522-B.
4. Paint Adhesion: ASTM D3359-B.
5. Resistance to Saltwater Corrosion: ASTM B117, ASTM D1654.
6. Resistance to Humidity: ASTM D1735, ASTM D1654.
7. Impact Resistance: ASTM 2784.
8. UV Protection: SAE J1690.

2.12 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with IEEE 115 and with NFPA 110, Level 1 Energy Converters.

B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Test generator, exciter, and voltage regulator as a unit.
3. Full load run.
4. Maximum power.
5. Voltage regulation.
6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdown.
9. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
10. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service in accordance with requirements indicated:

1. Notify Owner and Construction Manager no fewer than 10 working days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

3.3 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

C. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
3. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure engine generator and enclosure to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 260548.16 "Seismic Controls for Electrical Systems."
4. Remote Radiators:

    a. Install remote radiator with restrained spring isolators on concrete base on grade.
    b. Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators. These items are specified in Section 077200 "Roof Accessories."

D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

E. Cooling System: Install Schedule 40, black steel piping with welded joints for cooling water piping between engine generator and heat exchanger. Piping materials and installation requirements are specified in Section 232113 "Hydronic Piping."

1. Install isolating thimbles where exhaust piping penetrates combustible surfaces. Provide a minimum of 9 inches (225 mm) clearance from combustibles.
2. Insulate cooling system piping and components in accordance with requirements in Section 230719 "HVAC Piping Insulation."

F. Exhaust System: Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.

1. Install flexible connectors and steel piping materials in accordance with requirements in Section 232116 "Hydronic Piping Specialties."
2. Insulate muffler/silencer and exhaust system components in accordance with requirements in Section 230719 "HVAC Piping Insulation."
3. Install isolating thimbles where exhaust piping penetrates combustible surfaces with a minimum of 9-inch (225-mm) clearance from combustibles.

G. Drain Piping: Install condensate drain piping to muffler drain outlet with a shutoff valve, stainless steel flexible connector, and Schedule 40, black steel pipe, the full size of the drain connection, with welded joints.

H. Gaseous Fuel Piping:

1. Natural gas piping, valves, and specialties for gas distribution are specified in Section 201300 "Pipes."
2. LP gas piping, valves, and specialties for gas piping are specified in Section 201300 "Pipes."

I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

C. Connect cooling-system water piping to engine generator and remote radiator/heat exchanger with flexible connectors.

D. Connect engine exhaust pipe to engine with flexible connector.

E. Provide connection to portable generator docking station (to be mounted on shared equipment pad) per NEC 700.3 requirements. Connect per manufacturer's requirements and test for reliability of connection with portable generator per IEEE standards.

F. Gaseous Fuel Connections:

1. Connect fuel piping to engines with a gate valve and union and flexible connector.
2. Install manual shutoff valve in a remote location to isolate gaseous fuel supply to the generator.
3. Vent gas pressure regulators outside building a minimum of 60 inches (1500 mm) from building openings.

G. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

H. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

I. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.5 IDENTIFICATION

A. Identify system components in accordance with Section 230553 "Identification for HVAC Piping and Equipment" and Section 260533 "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.6 FIELD QUALITY CONTROL

A. Testing Agency:

1. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs below as specified in the NETA ATS. Certify compliance with test parameters.

    a. Visual and Mechanical Inspection:

        1) Compare equipment nameplate data with drawings and specifications.
        2) Inspect physical and mechanical condition.
        3) Inspect anchorage, alignment, and grounding.
        4) Verify the unit is clean.
        5) Test protective relay devices.
        6) Verify phase rotation, phasing, and synchronized operation as required by the application.
        7) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
        8) Perform vibration test for each main bearing cap.
        9) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells in accordance with manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test (non-enclosed units): Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
9. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 percent and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations 23 ft. (7 m) from edge of the generator enclosure, and adjacent to building at event level, and compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest and reinspect as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.7 MAINTENANCE SERVICE

A. Retain this article for critical installations and consider including a provision for submitting a continuing maintenance agreement proposal. Revise starting date if required. Obtain

a copy of maintenance agreement before retaining or editing below. Maintenance contracts may not be allowed for publicly funded projects.

B. Initial Maintenance Service: Beginning at Substantial Completion, provide 18 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.
   1. A minimum of two (2) 8-hour sessions shall be provided for training of all owner staff for generator operation, servicing, and troubleshooting.
   2. The selected manufacturer shall provide an assigned service contact to the owner for future generator service and troubleshooting assistance.

END OF SECTION 26 32 13

SECTION 26 32 15 – EMERGENCY GENERATOR DOCKING STATION

PART 1 - GENERAL

1.1. GENERAL

1.2. QUALITY ASSURANCE

A. 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.

B. ETL/UL LISTED to 1008 Standards

C. UL 50 LISTED

1.3. COORDINATION

A. Coordinate layout and installation of Generator Docking Station, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.4. GUARANTEE/WARRANTY

A. Manufacturer Warranty shall be provided for a minimum of 1 Year,

1. Extended Warranty will be supplied upon at user's request at an additional charge from Manufacturer.

B. The equipment installed under this contract shall be left in proper working order

C. New materials and equipment shall be guaranteed against defects in composition, design or workmanship. Guarantee certificates shall be furnished.

PART 2 - PRODUCTS

2.1 DOCKING STATION

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. TRYSTAR: Docking Station

2. TRYSTAR Model No.: GDS-3

3. TRYSTAR One-Line Code: SBDS-3 DBDS-1

4. Other equals, as approved by the engineer and the owner.

2.2 GENERAL REQUIREMENTS

A. Enclosure

1. NEMA 3R Rain-Tight Aluminum Enclosure

i. Pad-lockable front door shall include a hinged access plate at the bottom for entry of temporary cabling that prevents unauthorized tampering while in use.

ii. NEMA 3R Integrity shall be maintained while temporary cabling is connected during use.

iii. Front and Side shall be accessible for maintenance.

iv. Top, Side, and Bottom shall be accessible for permanent cabling.

2. Powder coat

i. Paint after fabrication shall be Hammer tone Gray.

B. Phase, Neutral, and Ground Busbar

1. Material: Silver-plated Copper

2. Equipment Ground Bus: bonded to box.

3. Isolated Ground Bus: insulated from box.

4. Ground Bus: 50% of phase size.

5. Neutral Bus: Neutral bus rated 100 percent of phase bus.

C. Temporary generator connectors shall be Camlock style mounted on gland plate.

1. Camlock shall be 16 Series model and color coded according to system voltage requirements.

2. Camlock connections shall be Bus Bar Style, Cabling or Double Set Screw is not acceptable.

3. Camlock connection shall be protected against accidental contact while not in use .

D. Permanent Connection shall be factory installed broad range set-screw mechanical type, located behind a physical barrier.

E. Short Circuit & Withstand Rating

1. Shall be minimum 65 kAIC unless otherwise indicated on drawings.

F. Voltage & Amperage

1. 208Y/120V, frame size as noted on the contract documents.

G. Factory Installed Phase Rotation Monitor Device:

1. Phase monitoring relay to be Siemens 3U4512-1AR20 or equal and factory installed.

H. Optional Breaker Disconnects as Indicated on Project Drawings and Manufacturer Submittal Drawings:

1. Must be UL 489 Listed Breaker

2. Breakers shall be removable for service and maintenance.

I. Additional accessories shall be included in submittal drawing as follows:

1. Two Wire Auto Start

2. Battery Charger Receptacle 20A DUPLEX 125V

3. Battery Charger Receptacle 20A GFCI 125V

4. Block Heater Receptacle 30A L5-30 125V

5. 50A Twist-Lock 125V/250V

6. SCADA Terminal Port

7. Kirk Key Door Interlock

8. Listed Monitoring Device

9. Strip Heater & Thermostat

10. Surge Protection Device

11. Load Dump Receptacle

12. Utility Light/Alarm (Customer Specified)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive Generator Docking Station for compliance with 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. Surface, Flush or Base Mounted: Determined by Application

1. Install anchor bolts to elevations required for proper attachment to Generator Docking Station.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

C. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FACTORY COMMISSIONING

A. Upon completion of the installation, the docking station shall be commissioned by the Manufacturer’s factory authorized technician.

B. <u>SCOPE OF WORK SHALL INCLUDE:</u>

1. Review and verify the installation of all Trystar components and verify the correct electrical flow as depicted on the one-line drawings.

2. (If Applicable) The Manufacturer’s authorized technician will set the long time, short time, instantaneous and ground fault protection settings on the Generator Docking Station circuit breaker(s) in accordance with the engineers specifications or as provided as part of the coordination study.

3. Factory training for on-site personnel to educate them on how to connect the GDS to a portable generator

4. The Manufacturer’s factory authorized technician shall, upon completion of the commissioning provide a written report to the

electrical contractor and electrical engineer indicating the completion of the work.

5. Any issue that is found during the start-up that is determined at that time to be a warranty issue will be covered by Manufacturer. Any issues that are specific to the scope for the electrical installing contractor are the sole responsibility of the installing contractor.

6. Upon successful completion of the commissioning, Trystar will provide a complimentary 12-month warranty extension, above and beyond the 12-month manufacturer warranty.

3.5 FIELD QUALITY CONTROL

A. Third Party Tests and Inspections to include the following:

   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Prepare test and inspection reports, including a certified report that identifies Generator Docking Station and that describes scanning results. Include notation

END OF SECTION 26 32 15

SECTION 26 36 00 – AUTOMATIC TRANSFER SWITCHES

1.1 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract Documents apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Micro-processor based Automatic transfer switches (ATS) rated 600V and less.

1.3 SUBMITTALS

A. Product Data: Include ratings and dimensioned plans, sections and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices and material lists for each switch specified.

B. Wiring Diagrams: Detail wiring for transfer switches and differentiate between manufacturer installed and field installed wiring. Show both power and control wiring.

C. Product Certificates: Signed by manufacturer certifying that products furnished comply with requirements and that switches have been tested for load ratings and short circuit closing and withstand ratings applicable to units for Project.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

E. Field Test Reports: Indicate and interpret test and inspection results for compliance with performance requirements.

F. Maintenance Data: For each type of product to include in maintenance manuals specified in Division 1. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay setting and calibration instructions, including software, where applicable.

1.4 QUALITY ASSURANCE

A. The ATS shall be certified to “ISO 9001 International Quality Standards”.

B. Manufacturer Qualifications: Maintain a service center capable of providing emergency maintenance and repairs at Project site with a 4-hour maximum emergency response time.

C. Source Limitations: ATS shall be furnished by the manufacturer of the engine generator set so as to maintain system compatibility and local service responsibility for the complete emergency power system.

D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70 Article 100, for emergency service under UL 1008, by a Nationally Recognized Testing Laboratory (NRTL) acceptable to the Authority Having Jurisdiction (AHJ) and marked for intended use.

E. Comply with NEMA ICS 1, NFPA 70 and NFPA 110.

F. Comply with UL 1008, unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH REQUIREMENTS

A. Comply with Level 1 equipment according to NFPA 110.

B. Indicated Current Ratings: Rated for continuous load and transfer under full load.

C. Unless indicated differently on the one line diagram, the withstand and closing rating shall comply with the following:

1. 60 - 125A 25,000 AIC minimum

2. 150A – 400A 35,000 AIC minimum

3. 450A and above, 65,000 AIC minimum.

4. When the available fault current at the terminals of the ATS exceed the minimum AIC ratings specified above, UL Listed Series Ratings by upstream fuse or breaker shall be supplied to meet the fault current rating as indicated by the short circuit study. This shall be furnished at no additional cost to the Owner.

D. Annunciation, Control and Programming Interface Components: Devices at ATS shall have communications capability matched with remote programming devices such as annunciators and control panels.

E. Solid State Controls: Repetitive accuracy of all settings is plus or minus 2% or better over an operating temperature range of minus 20 to plus 70 deg C.

F. Resistance to Damage by Voltage Transients: Components meet or exceed voltage surge withstand capability requirements when tested according to IEEE C62.41. Components meet or exceed voltage impulse withstand test of NEMA ICS 1.

G. Enclosures: General purpose NEMA 250, Type 1, complying with NEMA ICS 6; UL 508, ATS located outdoors or in a damp/wet location shall be rated NEMA 3R.

H. Factory Wiring: Train and bundle factory wiring and label consistent with shop drawings.

1. ATS internal wiring shall be comprised of manufacturer installed harnesses marked for source and destination. Connection to the control system shall be by means of locking type disconnecting plugs, allowing control system to be disconnected and serviced without disconnecting power to the ATS.

2. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.

3. Power Terminal Arrangement and Field Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.

I. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operated mechanism, mechanically and electrically interlocked in both directions.

J. Switch Characteristics: Designed for continuous duty repetitive transfer of full rated current between active power sources.

1. Switch Action: Double throw, mechanically held in both directions.

2. Contacts: High pressure silver alloy for load current switching.

3. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover. Flame retardant, transparent covers shall allow viewing of switch contact operation but prevent direct contact with line voltage components.

4. ATS shall be 4 pole, 4 wire.

K. Switching Arrangement: Double throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

L. Manual Switch Operation: Under load, and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

M. Signal before Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

N. Digital Communications Interface: Matched to capability of remote annunciator or annunciator and control panel.

2.2 AUTOMATIC TRANSFER SWITCH FEATURES

A. Undervoltage Sensing for Each Phase of Normal Source: Senses low phase to ground voltage on each phase. Pickup voltage is adjustable from 85 to 100% of nominal and dropout voltage is adjustable from 75 to 98% of pickup value. Factory set for pickup at 90% and dropout at 85%.

B. Time delay for override of normal source voltage sensing delays transfer and engine start signals. Adjustable from 0 to 6 seconds and factory set for 1 second.

C. Voltage/Frequency Lockout Relay: Prevents premature transfer to generator set. Pickup voltage is adjustable from 85 to 100% of nominal. Factory set for pickup at 90%. Pickup frequency is adjustable from 90 to 100% of nominal. Factory set for pickup at 95%.

D. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes; factory set for 10 minutes. Provides automatic defeat of delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

E. Unassigned Auxiliary Contacts: 2 single pole double throw contacts for each switch position, rated 10Amps at 120V AC.

F. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

G. Engine Starting Contacts: 1 isolated, normally closed and 1 isolated, normally open, rated 10Amps at 32V DC minimum.

H. Engine Shutdown Contacts: Time delay adjustable from 0 to 5 minutes; factory set for 5 minutes. Initiates shutdown at remote engine generator controls after retransfer of load to normal source.

I. Transfer Switch Control Panel:

1. Each transfer switch shall be provided with a control panel to allow the operator to view status and control operation. Control panel shall be a sealed membrane display, and permanently labeled for switch and control functions. Control panel shall be provided with the following features and capabilities:

a. High intensity LED lamps labeled “Normal Source” - green and “Emergency Source” - red, shall indicate the source the load is connected to and which source(s) are available. LED indicators

shall indicate the true condition of the sources as sensed by the control panel.

b. High intensity LED lamp labeled “Not In Auto” to indicate the mode selector switch is not in auto or the emergency stop button is pressed.

c. High intensity LED lamp labeled “Test/Exercise Active” to indicate such.

d. “Override” button to cause ATS to bypass any active time delays for start, transfer or re-transfer and immediately proceed with its next logical operation.

e. “Test” button to initiate a pre-programmed test sequence.

f. “Reset/Lamp Test” button that will clear all faults and test all lamps.

g. The control system shall include a real time clock and shall continuously log information on the following:

Actual number of operating hours for genset.

Number of hours each source has been connected to the load.

Number of times transferred.

Number of times each source has failed.

Fault history with date and time.

2. Analog AC Metering Display:

a. LED bargraph shall indicate AC voltage, amperage, KW, power factor and frequency.

b. LEDs shall be color coded, with green indicating normal range values, amber for warning levels and red for shutdown conditions.

J. Generator exerciser shall automatically start the engine and include the following features:

1. Solid state, push button programming control with digital display of settings and real time clock through alphanumeric display panel.

2. Run schedule shall be adjustable from 7 to 30 days, running periods adjustable from 10 to 30 minutes and selectable for transfer/no transfer.

3. Integral battery to maintain memory when normal control power is not available.

4. Automatic adjustment for daylight savings.

5. Unit shall be initially set for 7 day exercise cycle, 20 minute running period, no transfer, set to run on Tuesday, Wednesday or Thursday morning at 7:00am. Confirm this schedule with the owner during factory representative training and adjust if necessary. Exerciser features shall include the following:

K. Battery Charger mounted in or adjacent to transfer switch: Current limiting, automatic equalizing and float charging type. Unit shall comply with UL 1236 and shall include the following features:

a. Operation: Equalizing charge rate of 10 amps is initiated automatically after battery has lost charge and until an adjustable equalizing voltage is achieved at battery terminals. Unit automatically switches back to a lower float charge mode.

b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40 deg F to 140 deg F to prevent undercharging at low temperatures and overcharging at high temperatures.

c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10%.

d. Manufacturer provided fusing on AC input and DC output.

e. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.

f. Monitoring of battery and charger: The following abnormal conditions for the battery and charger shall be monitored and indicated on the control panel:

Low battery voltage.

High battery voltage.

Loss of ac input to charger or dc output to battery.

g. Any abnormal battery condition shall operate the Generator fault relay #2.

2.3 FINISHES

A. Enclosures: Manufacturer's standard enamel over corrosion resistant pretreatment and primer.

2.4 SOURCE QUALITY CONTROL

A. Factory Test Components, Assembled Switches and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency and time delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wall Mounted Switch: Level and anchor unit to wall.

B. The emergency power system equipment, (transfer switch, transformer, panels, etc) shall be located the minimum distance from the main switchboard as required in NFPA110.

C. Wiring from the transfer switch to the genset shall be installed in a minimum of 7 separate conduits, 1-1/4” minimum for power feeds, all others 3/4” minimum:

1. Main power feed(s). Each power feed shall be in separate conduits.

2. Remote annunciator wiring, shall not pass through ATS.

3. Building fire alarm system monitoring wiring, shall not pass through ATS.

4. Battery charger wiring.

5. Engine starting contact wiring.

6. Communication and control wiring.

7. Spare conduit, terminate in junction box in building, label “Spare to Genset”.

D. Identify components according to Division 26 Section "Electrical Identification."

3.2 WIRING TO REMOTE COMPONENTS

A. Match type and number of cables and conductors to control and communications requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Fire alarm wiring for generator run and fault monitoring, shall not pass through the transfer switch, or be installed in conduit with other wiring. There shall be a separate conduit for this wiring from the building to the generator.

3.3 CONNECTIONS

A. Ground equipment as indicated and as required by NFPA 70.

3.4 FIELD QUALITY CONTROL

A. Testing: Test transfer switch products by operating them in all modes. Perform tests recommended by manufacturer under the supervision of manufacturer's factory authorized service representative. Correct deficiencies and report results in writing. Record adjustable relay settings.

B. Coordinate tests with tests of generator plant and run them concurrently.

C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.5 CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt and debris. Repair damaged finish to match original finish.

B. Clean equipment internally and externally, on completion of installation, according to manufacturer's written instructions.

3.6 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's personnel to adjust, operate, and maintain transfer switches and related equipment as specified below:

1. Coordinate this training with that for generator equipment.

2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing and maintaining equipment.

3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."

4. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

5. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

6. Provide a minimum of 4 hours of instruction.

7. Warranty for this product is covered in the generator specification.

END OF SECTION 26 36 00

SECTION 26 43 13 - SURGE SUPPRESSION SYSTEMS

1. GENERAL

   A. Each Contractor's attention is directed to Section 260501, General Provisions - Electrical and all other contract documents as they may apply to his work.

   B. Each Surge Suppression Unit (transient voltage surge suppressor, or T.V.S.S.) furnished shall meet or exceed U.L. 1449, Second Edition *Revision* (February 2007), with capacity for each basic Category A, B and C, surge rise time of ten microseconds and a surge duration of at least one thousand microseconds.

   C. SPECIAL NOTE: When using a “Meggar” or similar instrument to test conductors in a panelboard or switchboard, disconnect any T.V.S.S. device connected to any combination of those conductors. Failure to do so may damage or destroy the T.V.S.S. device. If any damage occurs as a result of testing to a T.V.S.S. device, the Contractor shall replace the device.

2. SCOPE OF THE WORK

   A. The Contractor shall provide the necessary labor, materials, wiring and services necessary to provide the complete electrical surge protection systems as specified herein. This work shall include, but is not necessarily limited to:

      (1) Provision of Surge Suppression Units at certain points in the power distribution network, on telephone, satellite dish leads and cable television service lines as indicated herein or on the drawings.

      (2) Proper installation of surge suppression unit(s), in accord with shop drawings. Wiring routing, grounding, raceways and all connections shall be in exact accord with manufacturer's recommendations, the National Electrical Code, and any other applicable regulations, local or national, or international.

3. QUALITY ASSURANCE

   A. The manufacturer shall be regularly engaged in production of surge protection equipment, of types, sizes and ratings required, whose products have been satisfactorily used in similar service for not less than three years.

   B. Comply with NEC and NFPA requirements, as applicable to materials and installation of surge protection components and wiring. Surge protection equipment shall be UL listed and labeled for its intended use. TVSS shall be labeled with 200kA Short Circuit Current Rating (SCCR). Where applicable, equipment shall comply with ANSI standards for such equipment.

C. SPECIAL NOTE: The physical routing, length and connections of the unit's phase, neutral and ground conductors are critical to the performance of surge suppression units. The Contractor shall carefully observe and comply with the manufacturer's installation requirements.

4. SUBMITTALS

A. Product Data: Submit manufacturer's data on surge protection systems and components as part of shop drawing submissions. Indicate all capacity ratings, clamp times, maximum capacities, EMI/RFI attenuation data, withstand capabilities, physical construction and listing agency approvals.

B. Maintenance Data: Submit maintenance instructions for surge suppression system. Include this data in Operation and Maintenance manuals.

5. MATERIALS

A. ACCEPTABLE MANUFACTURERS

Subject to compliance with requirements, manufacturers offering surge protection components which may be incorporated in the work includes, but are not limited to, the ones listed below. Other manufacturers will be considered if their proposed products are in full compliance with these specification requirements.

Surge Protective Devices:

Liebert Corporation, Inc
General Electric Corporation
Transtector, Inc.
Advanced Protection Technologies, Inc.
Square D. Inc.

6. T.V.S.S. MINIMUM REQUIREMENTS

T.V.S.S. minimum requirements shall meet or exceed the following criteria:

A. Minimum surge current capability (single pulse rated) per phase shall be:

(1) Service entrance applications: 200 kA per phase (Category “C”)
(2) Distribution applications: 120 kA per phase (Category “B”)
(3) Non-receptacle applications: 40 kA per phase (Category “A”)
(4) Receptacle applications: 12 kA per phase (Category “A”)

B. UL 1449 Listed Suppression Voltage Ratings for service entrance shall not exceed the following: (Category “C”)

VOLTAGE	L-N	L-G
	N-G	MCOV
208Y/120V	400	
	400	400
	150V	
240Delta/120V	400	400
	400	
	150V	
480Y/277V	800	
	800	800
	320V	

(With internal disconnect switch 400V and 800V respectively).

C. UL 1149 Listed Suppression Voltage Ratings for distribution shall not exceed the following: (Category “A” & “B”)

VOLTAGE	L-N	L-G
	N-G	MCOV
208Y/120V	400	
	400	400
	150V	
240Delta/120V	400	400
	400	
	150V	
480Y/277V	800	
	800	800
	320V	

(With internal disconnect switch 400V and 800V respectively)

(L-N = Line to neutral)
(L-G = Line to ground)
(N-G = Neutral to ground)
(MCOV = Maximum continuous operating voltage)

7. BUILDING ELECTRICAL SERVICE SURGE PROTECTION SYSTEM COMPONENTS

A. GENERAL

(1) Provide UL 1449 Second Edition *Revision* (February 2007) listed and labeled lightning and transient surge protection devices, installed where shown on the drawings and in accord with the manufacturer's recommendations.

(2) The surge protection devices shall be shunt type and polyphase, with the ability to conduct high energy transients from line to ground, line to neutral and neutral to

ground. Provide in a NEMA 12 enclosure with hinged or screw cover front panel. Provide internal fusing in modules to protect unit.

(3) Provide units with EMI/RFI noise attenuation, using 50 ohm insertion loss test: -50 dB at 100 khz, UL 1283 listed, with an insertion ratio of 50:1 using M.I.L. STD 220-A.

(4) For each surge suppression unit, categories A, B & C, provide unit function status indicators. These indicators shall be mounted in the face of the equipment panel. Provide green L.E.D., illuminated for normal operation, red L.E.D. for trouble/fault or reduction of surge suppression capacity. Provide an audible alarm with silence switch to alarm at unit on malfunction for category "C" units only. Provide a resettable surge counter for each category "C" unit to indicate each suppression operation of the unit.

(5) Enclosures shall be surface-mounted where panels protected are surface-mounted, flush-mounted for all units in finished areas. Where panels protected are flush-mounted, place surge suppression device above or below panel, aligned and square with panel trim.

(6) Provide disconnecting means for each surge protection device per the following:

Category "C" Device at Main Service:
40 to 60 Ampere, 3 Pole, 600V, S/N, NEMA 1 disconnect, built into the unit and furnished by the supplier as an integral part of the equipment. Disconnecting means shall be capable of withstanding the available fault currents. Verify fault current with the Contractor.

Category "B" Devices, at Panels:
30 Ampere, 3 Pole Circuit Breaker in Protected Panel

Category "A" Devices, at Panels:
30 Ampere, 3 Pole Circuit Breaker in Protected Panel

(7) Internal Device Overcurrent Protection (Fusing)

a. All protection modes (including Neutral to Ground) of each surge suppression device shall be internally fused at the component level with fuse I^2t capability allowing the suppressor's maximum rated transient current to pass through the suppressor without fuse operation. Every suppression component of every mode (including Neutral to Ground) shall also be protected by thermal overtemperature controls. If the rated I^2t characteristic of the fusing is exceeded, the fusing shall be capable of opening in less than one millisecond and clear both high and low impedance fault conditions. The fusing shall be capable of interrupting up to 200 KA symmetrical fault current with 600 VAC applied. This overcurrent protection circuit shall be monitored, to provide indication of suppression failure. Conductor level fuses or circuit breakers internal or external to the surge suppression units are not acceptable as meeting this requirement.

B. MAIN SERVICE SURGE SUPPRESSION - CATEGORY "C" UNITS

(1) Category "C" units shall be installed on the service entrance or building entrance equipment. Units shall be rated 277 volts/480 volts (or 120/208 volts as needed), 3 phase, 4 wire, minimum 200,000 amp (total amps per phase) surge capacity, with less than 5 nanosecond reaction time. Category "C" units installed to protect a switchboard may be built into the switchboard construction if U.L listed for such applications.

(2) Category "C" withstand capabilities: 5,000 A.N.S.I. Category C3 surges with less than 10% change in clamping voltage.

C. PANELBOARD SURGE SUPPRESSION - CATEGORY "B" UNITS

(1) Units shall be installed as indicated herein or on the contract drawings, set beside or above the distribution panel indicated, and connected as recommended by the equipment manufacturer.

(2) All emergency system switchgear, distribution panels and branch panelboards shall be provided with surge protection devices in accordance with the NEC.

(3) Category "B" units shall be rated for 277-480 volts (or 120/208 volts, as indicated), 3-4 Wire Wye service. Units shall be minimum 120,000 ampere rated per phase, with less than 5 nanosecond reaction time. Provide fusing and fault indicator pilot lights as in (A) - General above.

(4) Category "B" withstand capabilities: 5,000 A.N.S.I. Category C3 surges with less than 10% change in clamping voltage.

D. BRANCH PANELBOARD SURGE SUPPRESSION - CATEGORY "A" UNITS (NON-RECEPTACLE APPLICATIONS)

(1) Units shall be installed as indicated herein or on the contract drawings, set beside or above the panelboard indicated, and connected as recommended by the equipment manufacturer.

(2) All emergency system switchgear, distribution panels and branch panelboards shall be provided with surge protection devices in accordance with the NEC.

(3) Units shall be installed flush in finished areas. Units may be surface-mounted if in unfinished mechanical spaces and the panel protected is also surface-mounted.

(4) Category "A" units shall be rated for 277/480 volts or 120/208 volts, three phase, 4 wire wye service as indicated on the drawings. Units shall be rated 40,000 amperes surge current, less than one nanosecond response time. Units shall be fused in accord with (A) - General noted above.

(5) Furnish unit with red and green indicator lights to signify normal operation and component or suppression capability failure.

E. TELEPHONE AND TELEVISION SURGE SUPPRESSION

(1) As a part of this section of work, the Contractor shall provide or arrange for the installation of U.L. listed lightning and surge arrestors on the incoming telephone and television service lines, as well as on AM-FM- antenna downleads and the coaxial cables coming into the building from satellite dish antennas and all other types of exterior antennas installed by the Contractor or Owner, where the Contractor installs the coaxial cable for the antenna.

(2) Arrestors shall be U.L. listed, properly grounded per N.E.C., and shall be located at the service entrance points for each cable installed by a utility company or at the point of building entry for Contractor-installed cables leading in from antennas. Also provide surge arrestors of the proper type for any copper cables that are installed between buildings by the Contractor, if such a condition occurs within the project.

(3) The Contractor shall arrange for the telephone company to install M-O-V, gas-type or other U.L. listed lightning arrestors on each of their incoming telephone circuits that are terminated for building use.

(4) Arrestors for coaxial lines shall be rated 25 to 250 MHZ on cable T.V. lines, and 250 MHZ to 1GHZ on satellite dish lead-ins with BNC jacks in/out or as required by antenna connectors.

(5) Devices as manufactured by Lucent Technologies, Winegard or Liebert Corporation will be acceptable.

(6) Provide a ground lug for individual surge suppression unit installations, with the recommended ground wire size routed back to the building main electrical ground or ground bar in wiring closet.

(7) Where multiple surge suppression units are installed, as at service entrance locations, provide a ground bar, copper, with multiple tapped holes and a properly sized ground lead routed back to the building main electrical ground.

8. EXECUTION

A. Installation of Surge Protection Systems:

(1) Install surge protection systems as indicated and in accordance with equipment manufacturer's written instructions, in compliance with applicable requirements of NFPA, local prevailing codes and with UL lightning and power surge protection standards to ensure that surge suppression systems comply with requirements.

(2) Coordinate with other work, including electrical wiring work as necessary to interface installation of units.

(3) Install conductors with direct, shortest possible phase, neutral and ground paths from all in/out connections, avoiding sharp bends and narrow loops.

(4) Install surge suppression units as close as practical to equipment they are protecting. Install appropriate units at main electrical service entrance equipment and secondary branch panelboards as indicated.

(5) Refer to the drawings for installation of individual surge suppression devices to protect branch circuits. Also see Section 262726 for (receptacle type) device requirements. All receptacle type surge suppression units shall be wired as feed-thru type, to protect all downstream outlets on that branch circuit unless otherwise indicated.

9. WARRANTIES

A. All surge suppression equipment shall be unconditionally warrantied by the Contractor for a period of one year from the date of project substantial completion. Where longer manufacturer's warranties are offered, they shall be made available to the Owner. Note these extended warranties in the Operations and Maintenance Manuals.

B. Category "C" devices to carry 5 year parts and on site labor unconditional warranty.

C. Category "B" and "A" devices to carry 5 year unconditional replacement warranty.

END OF SECTION 26 43 13

SECTION 26 51 13 - LIGHTING FIXTURES AND LAMPS

1. GENERAL

A. Furnish and install all lighting fixtures, as herein specified, complete with accessories for safe and effective operation. All fixtures shall be installed and left in an operable condition with no broken, damaged or soiled parts.

B. All items furnished shall comply with the latest standards applicable such as U.L., NEMA, etc., and shall bear labels accordingly. All fixtures shall be the color specified or as selected by the Architect. Wherever fixtures have evident damage, they shall be restored to new condition or shall be replaced. Likewise, fixtures showing dirt, dust or fingerprints shall be restored to new condition or shall be replaced.

C. A PDF copy of light fixture factory shop drawings and cuts, showing fixture dimensions, photometric data, installation data and, if applicable, air handling data, shall be submitted to the Engineer for written approval 30 days after bid date. (Submission shall be made via the University's online project management system.)

D. Locate pendant, surface mounted or chain-hung industrial fixtures in mechanical rooms and similar spaces to avoid ductwork and piping. Locate around and between equipment to maximize the available light. Request a layout from the Engineer if uncertain about an installation.

E. Alternate fixtures may be substituted for types specified by name or catalog number. Proposed substitutions must be submitted to the Engineer ten working days prior to bid date for written approval to bid. This written approval will only be issued in addendum form.

F. Where emergency battery packs are provided with fixtures (if any), they shall be connected to an unswitched power line and wired in accord with the manufacturer's recommendations. Test buttons and indicator lamps shall be visible and accessible with fixture door open, or shall be remotely flush mounted in the ceiling adjacent to the fixture.

G. Where remote emergency lighting transfer relays are provided, they shall be flush mounted in the ceiling adjacent to a controlled fixture. They shall be connected to an unswitched power line and installed in accord with the manufacturer's recommendations. Test buttons and indicator lamps shall be visible and accessible without removing ceiling tiles or access panels.

H. All reflecting surfaces, glass or plastic lenses, downlighting cones and specular reflectors shall be handled with care during installation to avoid fingerprints or dirt deposits. It is preferred that louvers be shipped and installed with clear plastic bags to protect louvers. At close of project, and after construction air filters are changed, remove bags. Any louver or cone showing dirt or fingerprints shall be cleaned with solvent recommended by the

manufacturer to a like-new condition, or replaced as necessary in order to turn over to the Owner new fixtures at beneficial occupancy.

I. Refer to architectural details as applicable for recessed soffit fixtures or wherever fixture installations depend upon work of other trades. Coordinate all installations with other trades. Verify dimensions of spaces for fixtures, and if necessary, adjust lengths to assure proper fit and illumination of diffuser and/or area below.

J. Warranty shall start at Final Project Completion.

K. This contractor is responsible for the installation of all owner furnished fixtures, as noted on the floor plans. Any deviation to the connection type or control scheme as laid out in the contract documents shall be brought to the attention of the engineer prior to installation and rough-in.

2. VOLTAGE

A. All lighting fixtures will be rated for multiple voltage classes, where available. If unavailable, all fixtures shall be rated for 120V.

3. LED FIXTURES

LED SOURCES

A. LED's shall be manufactured by a manufacturer who has produced commercial LEDs for a minimum of five (5) years.
B. Lumen Output – minimum initial delivered lumen output of the luminaire shall be as follows for the lumens exiting the luminaire in the 0-360 degree zone - as measured by IESNA Standard LM-79-08 in an accredited lab. Exact tested lumen output shall be clearly noted on the shop drawings.
C. Lumen output shall not decrease by more than 20% over the minimum operational life of 50,000 hours at the rated ambient operating temperature.
D. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
E. LED Boards shall be suitable for field maintenance and have with plug-in connectors. LED boards shall be upgradable
F. Light Color/Quality:
    a) Correlated Color temperature (CCT) range as per specification, between 3000K, 3500K and 4000K shall be correlated to chromaticity as defined by the absolute (X,Y) coordinates on the 2-D CIE chromaticity chart.
    b) Color shift over 6,000 hours shall be <0.007 change in u' v' as demonstrated in IES LM80 report.
    c) The color rendition index (CRI) shall be 80 or greater
    d) LED boards to be tested for color consistency and shall be within a space of 2.5 MacAdam ellipses on the CIE chromaticity chart.

LED DRIVERS

A. Driver: Acceptable manufacturer: eldoLED, Sylvania, or Philips that meet or exceed the criteria herein.
B. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
C. Driver should be UL Recognized under the component program and shall be modular for simple field replacement.
D. Electrical characteristics: 120 volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 80% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.
E. Dimming: Driver shall be suitable for full-range dimming. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100 percent to 0.1 percent of rated lumen output with a smooth shut off function unless specifically scheduled otherwise.
F. Dimming shall be controlled by a 0-10V signal unless otherwise specified.
G. Driver shall include ability to provide no light output when the control signal drops below 0.5 V, and shall consume 0.5 watts or less in this standby.
H. Driver shall be capable of configuring a linear or logarithmic dimming curve.
I. Drivers shall track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range regardless of the controller type
J. Flicker: Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have: Less than 1 percent flicker index at frequencies below 120 Hz and less than 12 percent flicker index at 120 Hz, and shall not increase at greater than 0.1 percent per Hz to a maximum of 80 percent flicker index at 800Hz
K. Driver disconnect shall be provided where required to comply with codes.

LED ELECTRICAL

A. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent at any standard input voltage and meet ANSI C82.11 maximum allowable THD requirements.
B. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A. To reduce false circuit breaker tripping due to turn on inrush, the following statement ensures that electronic dimming driver will meet NEMA inrush recommendations.
C. Rush Current: Meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 Amps2 – seconds.
D. RF Interference: The luminaire and associated on-board circuitry must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 Non-Consumer requirements for EMI/RFI emissions

E. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance.
F. Power Factor: The luminaire shall have a power factor of 90% or greater at all standard operating voltages and full luminaire output.

4. LIGHT FIXTURE GENERAL REQUIREMENTS

A. LED Recessed Lighting Fixtures - General Requirements

(1) The following are minimum requirements for recessed LED fixtures for lay-in grid, gypsum board, plaster and concealed spline ceilings. Surface-mounted LED fixture requirements shall be similar.

(2) Housings shall be a minimum of 4" depth, premium grade, constructed of a minimum 22 gauge die embossed or stiffened cold rolled pre-treated rust-resistant steel.

(3) All parts shall be finished with polyester powder or white baked enamel (85% minimum reflectance) painted after fabrication. All wiring shall be type TFN, or THWN and shall be covered by the steel driver cover or wiring channel. Exposed wiring is not acceptable. Connection wiring shall be accessible thru a hinged access plate above driver channel in top of unit.

(4) The complete light fixture unit shall be UL listed and labeled. Other agency listings may be acceptable with written approval from the Engineer.

(5) Fixture lens doors shall be reversible, hinged, painted after fabrication, with spring-loaded or other mechanically stable positive action latches.

(6) Lens shall be as specified for each fixture type. If a specific manufacturer and series number of lens is listed, the substitute shall be of the exact specification (thickness, prism configurations, transparency, efficiency, photometric distribution, hardness, vandal-resistance, etc.). Minimum average thickness of any prismatic lens shall be .125".

(7) Fixture trim and/or flanges shall conform with ceiling constructions as required. Verify all types prior to submission of shop drawings and indicate any special types on submittals. Fixtures installed in drywall or plaster ceilings to be provided with flange, screed and swing gate anchoring system.

(8) All fixtures shall be furnished with hold down clips to meet applicable seismic codes, four clips per fixture minimum or the equivalent thereof in the installation trim. Verify thickness of drywall or plaster ceilings prior to submission of shop drawings, to allow for proper trim adjustment.

(9) Support fixtures with one hanger wire at each end. Hanger wires shall be installed within 15° of plumb, maximum or additional support shall be provided. Wires shall be

attached to the fixture body and to the building structure - not to the supports of other work or equipment.

(10) Each type of lay-in fixture shall be furnished with the proper housing flange or lip to suit the type of lay-in grid(s) being utilized on the project. The Contractor is to verify if narrow or standard grid members are being furnished and provide the proper type of light fixture trim. Indicate any special trims on shop drawing submittals.

B. Industrial and Striplight LED Fixtures - General Requirements

(1) Units shall have die-formed heavy gauge cold rolled steel channels and die-embossed reflectors.

(2) Finishes to be coated with a gloss powder paint or baked enamel finish with a minimum 85% reflectance.

(3) Units to have aligner clips where required for a continuous row appearance. Where continuous rows exceed twelve feet in length, provide a "unistrut" channel or similarly adequate mounting to stiffen and align row.

(4) Units to have captive latches for all covers and wire guards where specified. Wire guards shall be heavy-duty #14 wire gauge minimum with corrosion-resistant plated or vinyl finish.

(5) Units to be UL listed.

(6) Mounting brackets and hanging mechanisms shall be as specified in fixture descriptions, or as required. Allow a generous safety margin with all support systems, as recommended by the manufacturer.

C. Recessed Downlight - General Requirements

(1) Fixture to have an extruded or die-cast aluminum housing. Retaining mechanism shall provide easy access to LED array and driver box.

(2) Unit to have a corrosion-resistant steel junction box with hinged access covers and thermal protector.

(3) Mounting/plaster frame to be heavy gauge steel with finishing trim friction support springs, for the required ceiling thickness. Trim to be of color as selected by the Architect.

(4) Optical system to consist of a sealed LED module with diffuser.

(5) Provide telescoping channel bar hangers that adjust vertically and horizontally.

(6) Fixtures to be UL listed for thru-branch circuit wiring, recessed, and damp locations. Where installed in plaster or drywall or other inaccessible ceiling type, they shall be U.L. listed for bottom access.

D. Exit Lights - General Requirements

(1) Housings and canopies shall be die-cast aluminum or corrosion resistant steel. Edge-lit clear acrylic panel shall be provided where scheduled. Mountings shall be wall or ceiling, universal type, to suit the installation conditions.

(2) Provide with stencil face, lettering color red, of sizes in accord with code, or as otherwise specified.

(3) Provide single or double face as scheduled, indicated on plans or as required by the local authority having jurisdiction. Adjust installation position if required for clear visibility, in accord with applicable codes.

(4) Complete unit to be finished in color as selected by the Architect. Provide directional arrows as indicated on plans, as scheduled to suit the means of egress or as required by the local authority having jurisdiction.

(5) All exit signs shall be long life LED type.

(6) Where emergency backup battery packs are provided with exit lights, they shall have capacities for continuous operation per applicable codes. They shall have reserve battery capacity to operate remote lamps where indicated.

5. LIGHTING FIXTURE SCHEDULE
   A. Refer to the contract drawings for Lighting Fixture Schedule. All fixture finishes shall be at the final discretion of the owner and the architect.

6. CONTROLS
   A. Refer to Specification 26 09 23-Lighting Control Devices for switching and controls.

END OF SECTION 26 51 13

SECTION 26 55 61 - THEATRICAL LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications section, apply to work of this section.

B. Division 26 Basic Materials and Methods sections apply to work of this section.

1.02 INTENT

A. The intent of this specification is to provide for furnishing all necessary equipment, as detailed on drawings and/or schedules, for a complete lighting and control system. For the sake of brevity, these specifications shall omit phrases such as "Contractor shall furnish and install", "unless otherwise indicated or specified", etc., but these phrases are nevertheless implied. Mention of materials and operations requires the Contractor to furnish and install such materials and perform such operations completely to the satisfaction of the owner' s representative.

B. Lighting Control Narrative

1. Stage lighting is to be independent of houselight system.
2. Stage Preset Station is to have 8 presets to capture stage lighting looks
3. 1 button station to capture main stage looks for rehearsals.
4. Preset record is to require no tools or special software.
5. The portable theatrical console shall have full individual control of the stage fixtures.

1.03 QUALITY ASSURANCE

A. Manufacturer shall be one who has been continuously engaged in the manufacturer of lighting control equipment for a minimum of ten years.

B. All equipment, where applicable standards have been established, shall be built to the standards of Underwriters Laboratories, Inc., the National Electric Code and the United States Institute for Theater Technology. Permanently installed power distribution equipment such as dimmer racks and distribution shall be UL and C-UL Listed, and/or CE marked (where applicable) and bear the appropriate labels. Portable equipment such as consoles and fixtures shall be UL and C-UL Listed, ETL Listed and/or CE marked (where applicable) and bear the appropriate labels. Equipment specified herein shall be the sole responsibility of a single theatrical systems integrator.

1.04 APPROVALS

A. The following manufactures are the basis of design and shall be considered approved:

1. Acuity Controls
2. Chauvet Professional
3. The Light Source

B. Prior approval is required for alternate proposals.

C. Specific items of equipment are specified by trade names. It has been determined by the systems designer that these are the particular items desired by the Owner and establish a standard of quality, equipment function and/or process. It is not the purpose or intent of these documents to eliminate competitive bids. In order to allow proper and fair comparison of pricing, contractors are required to submit their base bid price on the specified equipment. A contractor may submit an alternate bid based on equipment different from that specified only if that Contractor has received prior approval in writing from the Architect at least 10 days prior to bid. Accompanying each request shall be a letter specifically detailing each substitution including catalog data, specifications, operative samples, technical information, drawings, performance and test data, and complete descriptive and functional information to assist in a fair evaluation. Failure to submit any substitution for prior approval or not providing sufficient data for evaluation shall require the exact item specified to be furnished. Architect's approval of a substitution for bid purposes will not relieve the contractor from the responsibility of meeting all specification criteria. If an approval of a substitution is granted, the Contractor shall be fully responsible for any and all changes (wiring, power, distribution, support structure, etc.) such substitution shall require.

1.05 SCOPE

A. The work included under this specification shall cover all labor, materials, and equipment to furnish the lighting control system herein specified.

1. The electrical contractor is responsible for installing the equipment provided.
2. The electrical contractor is responsible for installing the portable theatrical lighting fixtures.
3. The electrical contractor is responsible for all wiring terminations at equipment supplied in this specification.
4. The electrical contractor shall furnish all conduit, wire, connectors, hardware and other incidental items necessary for the complete and proper operation of the lighting control system.
5. The controls manufacturer or representative is responsible for commissioning of controls including end user training.

B. No part of the system shall be energized before being so checked and the installation approved. Failure to observe this provision shall automatically relieve the manufacturer of any responsibility concerning the proper operation of the system or any part thereof and the replacement of parts that may have been damaged by the premature energizing.

1.02 SUBMITTALS

A. The manufacturer shall provide one (1) complete set of electronic submittal drawings for approval, prior to manufacture of any of the components. Submittals shall include:

1. Full system riser diagram(s) illustrating interconnection of system components, wiring requirements, back box sizes and any special installation considerations.
2. Full set of printed technical data sheets.
3. Detailed set of dimmer schedules
4. Detailed set of circuit and control schedules, including a complete list of all deviations from specifications.

B. On the dimming system, bidders submitting other equipment shall include all pertinent information showing in what respect the system will function in accordance with the specifications. In the case of substitution of the control system, the bidder shall submit the name of the manufacturer and a list of three or more operating systems (with names and telephone numbers of contacts).

C. All fixtures supplied shall meet or exceed the mechanical, electrical, optical, and performance data published for the equipment listed herein.

D. If required by the Architect or Engineer, the bidder shall provide at his expense, samples of proposed units for testing by an independent testing laboratory. All costs for these tests shall be the responsibility of the bidder.

E. It shall be understood that any additions or revisions of wiring required by the use of substitute equipment shall be the responsibility of the bidder making the substitution.

F. Field commissioning and instructional checkout shall be provided within 21 days of written request by the electrical contractor.

G. If the installation is not sufficiently complete to perform the checkout upon arrival of the factory certified field service technician, all costs for the additional trips shall be paid by the contractor.

1.03 SHOP DRAWING REVIEW AND APPROVAL

A. Shop drawings shall be furnished for approval prior to fabrication of the equipment. A set of drawings shall be returned, appropriately marked, as the approval document.

B. When the installation is complete, the owner shall be supplied with "as built" drawings which shall be incorporated as part of the Operation and Maintenance Manual. Maintenance information shall be provided on all major units and principal components of the system.

1.04 WARRANTY

A. The manufacturer shall warrant this equipment to be free from defects in material and workmanship for a period of thirty-six (36) months from the date of shipment.

B. Nothing in this guarantee shall cause repair or replacement by the Contractor where negligence, neglect or improper operation by the Owner has caused the failure of any equipment installed under this contract.

1.05 STANDARDS

A. All lighting instruments and control system components, where applicable standards have been established shall follow the recommendations of a National Registered Testing Laboratories and the National Electrical Code, and must bear appropriate labels.

B. Manufacturers

1. Provide products by the manufacturers indicated on the drawings and specifications. This apparatus is fully catalogued and described with complete technical data available from the manufacturers.
2. The theatrical lighting and control equipment basis of design is as specified in these documents.
3. The listing of a manufacturer as "equivalent systems" does not imply automatic approval. It is the responsibility of the Electrical Contractor to ensure that any price quotation and products meets or exceed the specifications herein.

PART 2 - PRODUCTS

1.10 0-10V Dimming & Relay Panel

C. General

1. Basis of Design: SNAP Lighting Control Panel.
2. Convert DMX512 signal to analogue DC.
3. Convert DMX512 signal to relay control.
4. Variants:
   a. Variant 1: Eight relays.
   b. Variant 2: Sixteen relays.

D. Mechanical

1. Housing:
   a. Type 1 NEMA enclosure.
   b. Black powder coat 18 gauge steel.
   c. Four 3/4 inch, 1-inch, 1.25-inch line voltage conduit knockouts.
   d. Two 3/4 inch low voltage conduit knockouts.
   e. Front hinged cover.
   f. Steel internal dead front hinged door and high voltage barrier.
2. Mounting: Four round keyholes.
3. Ports:
   a. Two 3-pin male headers for DMX512.

b. One 14-pin double row male header for power in.
c. Four 10-pin double row male headers for relay output and input.
d. One 3-pin male header for contact closure.
e. Four 5-pin male headers for analog outputs.
f. Line voltage terminal variants:
1) Variant 1: Sixteen AC screw flange wire terminals.
2) Variant 2: Thirty-two AC screw flange wire terminals.

4. Detachable Accessories:
a. Two 3-pin male headers to wire stop IDC terminal block.
b. Three 3-pin male headers to screw flange terminal blocks.
c. Four 5-pin male headers to screw flange terminal blocks.
5. One single pole slide switch for DMX512 termination.
6. One single pole slide switch for controller by-pass.
7. User Interface:
a. Four momentary contacts.
b. Five digit 7-position LED display.

E. Electrical

1. Controller power in:
a. 120 volts AC
1) 500 milliamps.
b. 277 AC.
1) 200 milliamps.
2. Line voltage relay power in:
a. 120 volts AC.
b. 277 volts AC.
c. 347 volts AC.
3. DMX512 port protection
a. Fault and overcurrent: 250 volts AC thermal switch.
b. Isolation: 1500 volts AC.
4. Analog port isolation: 2500 volts AC.
5. Analogue ports
a. Minimum: Negative 15 volts DC.
b. Maximum: 15 volts DC.
c. Sourcing milliamps: 10.
d. Sinking maximum input milliamps: 100.
6. Line voltage relays
a. Quantity
1) Variant 1: 8.
2) Variant 2: 16.
b. Maximum load:
1) 120 volts: 20 amps.
2) 277 volts: 30 amps.
3) 347 volts: 20 amps.

7. Single-color integral LED status indicators:
    a. One power.
    b. One status.
    c. One DMX512 input.
    d. Six configuration.
8. Hardwired unpowered DMX512 thru port.

F. Functional

1. Standalone and independent operation.
2. Continuous operation when energized.
3. Contact closure for fire alarm override.
4. Input signals: DMX512.
5. Output signals
    a. Default: Analogue sourcing.
    b. Upon detection: Analogue sinking.
6. Output analogue channel variants:
    a. Eight.
    b. Sixteen.
7. Single-color integral LED status indicators:
    a. Blue power
        1) On: Receiving power.
        2) Off: Not receiving power.
    b. Red status
        1) On: Normal.
        2) Off: Not receiving power.
    c. Blue power on and red status off: Processor failure.
    d. Amber DMX512 input
        1) On: Receiving DMX512 signal.
        2) Off: Not receiving DMX512 signal.
    e. Amber functional
        1) On: Numerical value is displayed.
        2) Off: Numerical value not displayed.
8. Configuration
    a. Respond to RDM signal.
    b. Address mode: Set starting DMX512 address.
    c. Patch mode:
        1) Set individual channel and DMX512 address.
        2) Two-character display: Display number of selected output channel.
        3) Three-character display: Display number of associated DMX512 address.
    d. Threshold mode
        1) Set trigger value for relays.
        2) 8-bit minimum: 001.

3) Analog minimum: 1 percent.
4) Maximum: 99 percent.

e. Aux-in mode: Set output control to respond to contact closure input.
f. DMX display mode:
1) Three-character display: Display number of selected DMX512 address.
2) Two-character display: Display intensity value of selected DMX512 address.
g. Relay test mode: Select output channel to full.

G. Environmental

1. Operating temperature
a. Minimum: 32 degrees Fahrenheit
b. Maximum: 104 degrees Fahrenheit
2. Operating non-condensing humidity
a. Minimum: 10 percent
b. Maximum: 90 percent
3. Cooling method: Passive convection.

1.11 Signal Processing Enclosure

H. General

1. Signal Processing Rack to be delivered fully assembled with internally wiring complete and ready for mounting conduit by EC

I. Wall Mount Enclosure

1. General
a. The eDIN System Wall-Mount Cabinet shall be a NEMA 1 sheet metal enclosure providing mounting facilities for a power supply and one or more Pathway eDIN modules and/or other DIN-rail mountable devices.
2. Physical
a. The eDIN Cabinet shall be constructed of 18 gauge steel with a formed aluminum cover, finished in textured black powder epoxy, and be clearly labeled “Pathway eDIN System.”
b. The cabinet shall be designed for surface mounting.
c. Dimensions of the (small) cabinet shall be 10.25”w x 13.25”h x 4.5”d (260mm x 335mm x 120mm).
d. Dimensions of the (large) cabinet shall be 10.25”w x 23.25”h x 4.5”d (260mm x 510mm x 120mm).
e. The cabinet shall be furnished with one or more sections of 35mm DIN rail for device mounting.
f. The cabinet shall be furnished with an adequate number of ½” and ¾”conduit knockouts.
3. Electrical
a. Provide a power supply of adequate capacity for the maximum number of modules the cabinet can accommodate.

b. The power supply shall be 24 VDC, Class 2, field-replaceable, wide-range input (115/240VAC, 50/60 Hz), UL-listed switching-type supply.
c. There shall be 2500-volt electrical isolation between input and output sections of the supply.
d. The power supply connections shall be capable of accepting up to #12 gauge solid or stranded wire.
e. The power supply shall be Pathway model #1001-30 or equivalent.
f. The cabinet shall be furnished with internal high-voltage barriers as required.
g. A suitable terminal shall be provided for ground wire connection.

4. Compliance
   a. The eDIN Cabinet shall meet the requirements of NEMA standards for Type 1 Enclosures.
   b. The eDIN Cabinet shall be ETL-listed.
   c. The eDIN Cabinet shall be compliant with the EU RoHS 2002/95/EC directive.

J. DMX/RDM Splitter

1. General
   a. Basis of Design: DMX512 Repeater DIN-mount 4 DMX512 Ports.
   b. Repeat optically isolated DMX512 and RDM signal.
   c. RDM variants:
      1) Non-RDM.
      2) RDM capable.
2. Mechanical
   a. Housing: UL94 5VA extruded rigid polyvinyl chloride.
   b. Mounting: Toolless TS35 DIN rail.
   c. Ports:
      1) Six 5-pin male headers for DMX512.
      2) One 5-pin male header for power in.
   d. Detachable Accessories:
      1) Six 5-pin male headers to wire stop IDC terminal block.
      2) Seven 5-pin male headers to screw flange terminal blocks.
   e. Non-RDM variant: One single pole slide switch for DMX512 termination.
3. Electrical
   a. Power in:
      1) Minimum: 9 volts DC
      2) Maximum: 36 volts DC.
      3) Milliamps: 667.
   b. Topology: Star.
   c. DMX512 port protection
      1) Fault and overcurrent: 250 volts AC thermal switch.
      2) Port to port optical isolation: 3000 volts AC.

3) DMX512 input to output in-line optical isolation.
4) DMX512 input to thru repeated electrically.

d. Single-color integral LED status indicators:
1) One Power.
2) One DMX512 input.
3) Non-RDM variant:
a) Four DMX512 output.
b) One 5-volt isolation.
4) RDM capable variant:
a) One processor.
b) One DMX/RDM.
c) Four RDM.
d) Four power isolation.

4. Functional
a. Standalone and independent operation.
b. Isolated repeated DMX512 communication.
c. RDM capable variant:
1) Respond to RDM signal.
2) Send RDM signal.
d. DMX512 port communication:
1) Non-RDM variant: Simplex DMX512.
2) RDM capable variant: Half-duplex DMX/RDM.
e. Single-color integral LED status indicators:
1) Blue power
a) On: Receiving power.
b) Off: Not receiving power.
2) Green processor
a) On: Normal.
b) Off: Not receiving power.
3) Blue power and green processor off: Processor failure.
4) Amber DMX512 input
a) On: Receiving DMX512 signal.
b) Off: Not receiving DMX512 signal.
5) Green DMX512 output
a) On: Transmitting DMX512 signal.
b) Off: Not transmitting DMX512 signal.
6) Red isolated power out
a) On: Power out.
b) Off: No power out.
7) Amber RDM
a) Flashing: Receiving RDM signal.
b) Off: Not receiving RDM signal.
f. Non RDM variant switch:

1) On: 120 ohms resistance on DMX512 thru.
2) Off: No resistance on DMX512 thru.

g. RDM capable variant processor
1) Memory: Non-volatile flash.
2) Firmware updates upload: Via latched DMX512 input signal.
3) Architecture: 8-bit RISC.
4) Speed: 16 Megahertz.
5) Memory:
a) 8 kilobyte flash.
b) 512 Bytes EEPROM.
c) 1 kilobyte internal SRAM.

h. RS485 transceiver:
1) Electrical data isolation.
2) 500 kilobits per second data rate.

5. Environmental
a. Operating temperature
1) Minimum: 14 degrees Fahrenheit
2) Maximum: 113 degrees Fahrenheit
b. Operating non-condensing humidity
1) Minimum: 5 percent
2) Maximum: 95 percent
c. Cooling method: Passive convection.

K. RS485 Architectural Gateway

1. General
a. Basis of Design: Vignette 485 Architectural Gateway.
b. Provide power and data to control DMX512 wall station.
c. Variants
1) Variant 1: Four Bus Gateway.
2) Variant 2: Four Bus Gateway with Two DMX512 Ports.
3) Variant 3: Four Bus Gateway with Two DMX512 Ports and 8 Contact Closures and 8 Programmable Momentary Contacts with Indicators.
4) Variant 4: Four Bus Gateway with 16 Contact Closures and 16 Programmable Momentary Contacts with Indicators.
5) Variant 5: Four Bus Gateway with Two RJ45 Jacks.
6) Variant 6: Four Bus Gateway with Two RJ45 Jacks and 8 Contact Closures and 8 Programmable Momentary Contacts with Indicators.

2. Mechanical
a. Mounting: Toolless TS35 DIN rail
b. Ports
1) Four 6-pin male headers for sACN data and power out.
2) One 5-pin male header for power in.

3) Two dual row 10-pin male headers.
4) One RJ45 jack for configuration and sACN data.
5) Three dual row 10-pin female header for expansion.
6) One 16-pin male header
7) Variant 2:
    a) Two 5-pin male headers for DMX/RDM.
8) Variant 3:
    a) Two 5-pin male headers for DMX/RDM.
    b) Two 5-pin male headers for contact closure.
9) Variant 4:
    a) Four 5-pin male headers for contact closure.
10) Variant 5:
    a) One RJ45 jack for configuration and sACN data.
11) Variant 6:
    a) One RJ45 jack for configuration and sACN data.
    b) Two 5-pin male headers for contact closure.

c. Materials:
    1) Powder-coat aluminum housing.
    2) Polycarbonate DIN rail mounting brackets.

d. Detachable Accessories
    1) Four 6-pin male header to wire stop IDC terminal blocks with eight 120 ohm 5% carbon film resistors.
    2) Four 6-pin male header to screw flange terminal blocks.
    3) One 5-pin male header to screw flange terminal blocks.
    4) One 5-pin female header polyimide jumper.
    5) Variant 2:
        a) Two 5-pin male header to screw flange terminal blocks.
        b) Two 5-pin male header to wire stop IDC terminal blocks.
    6) Variant 3: Four 5-pin male header to screw flange terminal blocks.
    7) Variant 4: Four 5-pin male header to screw flange terminal blocks.
    8) Variant 6: Two 5-pin male header to screw flange terminal blocks.

e. Button
    1) One mechanical momentary contact for factory default.
    2) Variant 3: Eight momentary contacts.
    3) Variant 4: Sixteen momentary contacts.
    4) Variant 6: Eight momentary contacts.

3. Electrical
    a. Power in:
        1) 82 watts DC

2) 24 volts DC
b. Bus power out:
1) 16 watts DC per bus
2) 24 volts DC
c. Topology: Daisy-chain
d. Single-color integral LED status indicators:
1) One power.
2) One identity.
3) Four bus.
4) Variants
a) Variant 2:
i. Two DMX512 output.
ii. Two DMX512 input.
b) Variant 3:
i. Two DMX512 output.
ii. Two DMX512 input.
iii. Eight contact closure.
c) Variant 4: Sixteen contact closure.
d) Variant 6: Eight contact closure.

4. Functional
a. Bus Protocol: Pathway ssACN
1) Maximum Bus Length
a) Category Cable: 328 unbroken linear feet.
b) Belden 9773: 984 unbroken linear feet.
b. Pathway ssACN Addresses: 2048.
c. Programming: snapshot and program of Pathway ssACN addresses.
d. Conversion: Pathway ssACN to DMX/RDM.
e. Asynchronous playback for four rooms.
f. Processor:
1) Architecture:
a) One Arm 32-bit Cortex.
b) Variant 2: One high-performance 32-bit RISC with 8KB SRAM.
c) Variant 3: One high-performance 32-bit RISC with 8KB SRAM.
2) Memory:
a) 1 gigabyte DRAM DDR3L 1.35V SDRAM
b) 16 megabyte non-volatile flash.
c) Variant 2: Two 256KB CMOS.
d) Variant 3: Two 256KB CMOS.
g. Network

1) 16-bit IEEE 802.3 ethernet controller with direct ISA-Bus interface:
   a) 4KB on-chip memory.
   b) MAC engine.
   c) 10BASE-T filters.
2) Variant 2: RS-485 transceiver:
   a) Electrical data isolation.
   b) 500 kilobits per second data rate.
3) Variant 3: RS-485 transceiver:
   a) Electrical data isolation.
   b) 500 kilobits per second data rate.

h. Variants 2 and 3:
   1) DMX/RDM communication.
   2) TCP/IP Input and Output Protocols
      a) sACN.
      b) Pathway ssACN.
      c) Art-Net.
      d) Strand ShowNet.
      e) Pathport.
   3) TCP/IP Receive Only Protocol: ETC Net2.
   4) Processor:
      a) Memory: Non-volatile flash.
      b) Firmware updates upload: Via ethernet and third-party computer.
      c) Architecture: 32-bit RISC.
      d) Speed: 40 megahertz
      e) Memory: 8 kilobyte SRAM.
      f) Device support:
         i. 8-bit.
         ii. 16-bit.

5. Environmental
   a. Operating temperature
      1) Minimum: 14 degrees Fahrenheit
      2) Maximum: 118 degrees Fahrenheit
   b. Operating non-condensing humidity
      1) Minimum: 5 percent
      2) Maximum: 95 percent
   c. Cooling method: Passive convection.

L. Manufacturers and Products:.

1. Basis of Design:
   a. Pathway Connectivity
   b. Acuity Controls
   c. Interactive Technologies

1.12 RS485 Digital Wall Station

M. General

1. Basis of Design: Vignette 485.
2. Lighting snapshot, playback, preset, and fader wall station.
3. Send xDMX
4. Labels:
   a. Top
   b. Bottom
5. Powder coat variants:
   a. White.
   b. Black.
6. Variants:
   a. Primary Insert
      1) Two button.
      2) Four button.
      3) One slider.
      4) Two slider.
      5) Three slider.
   b. Secondary Insert
      1) Two button.
      2) Four button.
      3) One slider.
      4) Two slider.
      5) Three slider.

N. Mechanical

1. Housing
   a. Mounting: Single piece stainless steel front plate.
   b. Injection molded polycarbonate back box.
   c. Stainless steel decorator wall plate powder coat variants:
      1) Black.
      2) White.
2. Mounting: 2 inches wide by 3 inches tall electrical box
   a. Maximum Wall Station Width: 6-inserts
      1) First Insert: 1 Primary.
      2) Maximum Additional Inserts: 5 Secondary.
3. Ports
   a. Primary Variant
      1) One 8-pin male header connector for Secondary Variant.
      2) Two 6-pin male headers for data and power in or out.
      3) Detachable Accessories
         a) Two 6-pin male header to screw flange terminal blocks.

b) Two 6-pin male header to wire stop IDC terminal blocks.

b. Secondary Variant
1) One 8-pin male header connectors.

4. Button Variant:
a. Injection molded elastomer.
b. Momentary contact.

5. Slider Variant:
a. Slide resistance potentiometer.

O. Electrical

1. Power in:
a. 1 watts DC.
b. 24 volts DC.

2. Single-color integral LED status indicators:
a. One single-color power.
b. One single-color link.

3. One Tri-colored per button or slider
a. Button colors: 256 parameters per color.
b. Slide Variant: 256 parameters per color.

P. Functional

1. Standalone and independent operation.

2. Primary Variant:
a. Connect via header with secondary variants.
b. Button Variant:
1) Independent playback of recorded scenes.
2) Snapshot program.
3) Record Allow
a) Is True: Push and hold individual button for 5 seconds to record current state.
b) Is False: Push and hold has no function.
c. Slider Variant: Manual control of recorded scenes.

3. Secondary Variant:
a. Connect to primary variant for system control.
b. Connect via header with primary or secondary variants
c. Button Variant: Independent playback of recorded scenes.
d. Slider Variant: Manual control of recorded scenes.

4. Tri-color integral LED status indicator
a. 24-bit color resolution.
b. Button Variant:
1) Amber: No sACN source found for selected universe.
2) Dark Amber: Lock button configured, inactive.
3) Light Amber: Lock button configured, active.
4) Blue: Button is currently pressed and held.

5) Light Blue: Snapshot activated, in progress.
6) Green: Snapshot recording complete.
7) Grey: Inactive recorded snapshot.
8) Magenta: Snapshot is overridden by slider.
9) Red: Record Allow is true.
10) Dark Red: Record Allow is false.
11) Pink: Priority override, active.
12) Purple: Snapshot deactivated, in progress.
13) Seafoam: Priority override, inactive.
14) Teal: Snapshot activated to override current snapshot.
15) Yellow: Deactivate snapshot.

c. Slider Variant:
1) Green: Grand master slider at full.
2) Red: Grand master slider is not at full.
3) White: Zone intensity as indicated.

5. Protocol: sACN
6. Configuration
a. Initial configuration via third-party computer.
1) Subsequent configuration via integral interface, specified herein.
b. Priority Control: Highest Takes Precedence
7. Maximum Bus Daisy-chain: 16
8. Slider variant: 256 programmable unique intensity states.

Q. Environmental

1. Operating temperature
a. Minimum: 14 degrees Fahrenheit
b. Maximum: 122 degrees Fahrenheit
2. Operating non-condensing humidity
a. Minimum: 5 percent
b. Maximum: 95 percent
3. Cooling method: Passive convection.

1.13 THEATRICAL LIGHTING CONSOLE

R. DMX512 Lighting Console

1. General
a. Basis of Design: Cognito2 Theatrical Console.
b. TCP/IP enabled DMX control.
c. Provide data to control DMX512 capable luminaires and devices.
d. Integral programmable interface software.
e. Variants:
1) Starter.
2) Pro
a) 512.

b) 1024.

2. Mechanical
   a. Housing: Injection molded plastic case fitted with steel base pan.
   b. Mounting: Tabletop.
   c. Rackmount variant mounting:
      1) 7-unit 19-inch server rack.
      2) Two symmetrical ears with eight unthreaded holes.
      3) One ear with two unthreaded holes.
   d. Ports: Recessed 12-inches from back of device for improved strain relief.
      1) Two female gold plated 5-pin XLR jacks for DMX512.
      2) One male gold plated 5-pin XLR jack for DMX512.
      3) One power over ethernet shielded RJ45 10 BASE-T/100 BASE-TX/1000 BASE-T jack.
      4) One 24 volt 2.5-millimeter barrel jack.
      5) One 19-pin high-definition monitor output.
      6) Three female 5-pin standard DIN.
      7) One male 9-pin d-subminiature for RS232 and contact closure.
      8) Four USB 2.0 type A jacks.
   e. Detachable Accessories
      1) 2.5-millimeter barrel jack AC adapter:
         a) Input voltage
            i. Minimum: 90 AC.
            ii. Maximum: 264 AC.
         b) Output voltage: 24 DC.
         c) Output maximum milliamps: 1,000.
      2) Dust cover.
   f. Anti-theft slot for lock.
   g. Two steel U-bolts for strain relief.
   h. Earth ground terminal.
   i. One recessed mechanical momentary contact for factory default.
   j. User interface:
      1) a. Forty-two momentary contacts
         a) One power.
         b) One pin.
         c) Twenty bump.
         d) Two go.
         e) Two shift.
         f) Four tool.
         g) Four attribute.
         h) Four function.
         i) Two cue and pause.

j) One memory black out.
k) One dead black out.

2) Twenty-four 60 millimeter analog slide resistance potentiometers
a) Twenty memory faders.
b) Two playback masters.
c) One grand master.
d) One memory master.

3) Four 360-degree incremental digital rotary encoders: Twenty-four detents.

4) One 7-inch capacitive programmable touch screen:
a) Resolution width: 800 pixels.
b) Resolution height: 480 pixels.
c) Color bit depth: 24-bit.

3. Electrical
a. Powered device: 15 watts.
b. Alternate low voltage power in:
1) Minimum: 12 volts DC
2) Maximum: 24 volts DC.
3) Milliamps: 1400.
c. Single-color integral LED status indicators:
1) Two DMX512 output.
2) One DMX512 input.
3) One MIDI output.
4) One MIDI input.
5) One MIDI thru.
d. Tri-colored integral LED status indicators:
1) One power type.
2) Forty-one momentary contact.
3) Sixteen digital rotary encoders, four per encoder.

4. Functional
a. Standalone and independent operation.
b. DMX communication.
c. DMX512 address output maximum variants
1) Starter: 512.
2) Pro
a) 512.
b) 1024.
d. Output signals:
1) DMX512.
e. Pro variants input signals:
1) DMX512.
2) MIDI show control.

3) MIDI timecode.
4) Contact closure.
5) RS-232.

f. Pro variants output signals:
1) MIDI show control.
2) RS-232.

g. TCP/IP Input and Output Protocols
1) sACN.
2) Pathway ssACN.
3) Pathport.
4) Pro variants:
a) Art-Net.
b) KiNET.

h. Momentary contacts:
1) Power
a) Console off: Boot console.
b) Console on: Force power down after six second button press.
c) Tri-colored integral LED status indicator
i. Pulsing blue: Stand-by mode.
ii. Solid blue: On.

i. Bi-color integral LED status indicator for Power type
1) Amber: Transformer power supply.
2) Red: Power over ethernet supply.

j. Processor
1) Central
a) Quantity: One.
b) Memory: Non-volatile flash.
c) Firmware updates upload
i. Via USB.
ii. Via ethernet and third-party computer.
d) Architecture: Cortex-A9.
e) Speed: 1200 megahertz.
f) Memory:
i. 128 kilobyte flash.
ii. 4 gigabyte SLC NAND.
iii. 64 gigabyte eMMC.
g) Operating system: Linux.
2) Auxiliary
a) Quantity: Two.
b) Memory: Non-volatile flash.
c) Firmware updates upload

i. Via USB.
ii. Via ethernet and third-party computer.
d) Architecture: ARM 32-bit cortex.
e) Speed: 24 megahertz.
f) Memory:
i. 128 kilobyte flash.
ii. 8 kilobyte SRAM.
g) Timer:
i. Capacity: 16-bit.
ii. Quantity: Twelve.

k. Networking
1) Single-chip 10Base-T/100Base-TX/1000Base-TX physical layer.
2) Link layer firewall port isolation.
l. Universal serial bus hub controller
1) Driver: 24-megahertz.
2) Ports: USB 2.0 Specification.
3) Power operation:
a) Self.
b) Bus.
4) Protection: 4 kilovolts powered and unpowered.
m. RS-232 interface
1) Data rate: 500 kilobits per second.
2) Voltage minimum: 3 DC.
3) Voltage maximum: 5.5 DC.

5. Environmental
a. Operating temperature
1) Minimum: 14 degrees Fahrenheit
2) Maximum: 122 degrees Fahrenheit
b. Operating non-condensing humidity
1) Minimum: 5 percent
2) Maximum: 95 percent
c. Cooling method: Passive convection.

S. DMX512 Lighting Console Operating System

1. General
a. Basis of Design: Cognito2 Operating System.
b. Provide computational tasks for the DMX512 Lighting Console specified.
2. Interface
a. Natural Language Control provides consistent unit values for luminaires and devices programmed in library.
b. USB peripheral support: Pre-installed firmware for standard human interface devices.

c. HMDI peripheral support: High definition 1080p external monitor.
   1) Resolution width: 1920 pixels.
   2) Resolution height: 1080 pixels.
d. Momentary contacts
   1) Power:
      a) Single momentary press: Report show file name and display menu.
      b) Double momentary press: Programmed power down.
   2) Pin: Hold intensity values and ignore slider input.
   3) Bump: Hold program at highest intensity for duration of button press. Configurable as toggle, timed or radio group.
   4) Go: Activate next recorded cue in sequence.
   5) Shift: Modifier key provides additional functions.
      a) Two shifts: Return to previous display.
      b) Shift tool: Restore attribute to default.
      c) Shift help: Disable help mode.
      d) Shift record: Revise active cue or memory.
      e) Shift pin: Modify pin timing.
      f) Shift play: Assert active cue.
      g) Shift pause: Release active playlist.
      h) Shift bump: Toggle bump button function.
   6) Tool: List selectable attributes.
   7) Intensity: Adjust intensity of selected luminaires.
   8) Color: Adjust color of selected luminaires.
   9) Position: Adjust position of selected luminaires.
   10) Shape: Adjust shape of selected luminaires.
   11) Pause and back
      a) First press: Pause fading cue.
      b) Second press: Restore previous cue.
   12) Memory black out:
      a) First press: Override all memories to off.
      b) Second press: Restore memories to previous state.
   13) Dead black out
      a) First press: Override all to off.
      b) Second press: Restore all to previous state.
   14) Release:
      a) First press: Restore selection to previous state.
      b) Second press: Clear selection.
      c) Third press: Restore all to previous state.
      d) Fourth press: Override all to off.
   15) Help:
      a) First press: Enable help mode.
      b) Subsequent press: Cycle through help windows.

16) Edit:
    a) First press: Activate edit menu.
    b) Second press: Execute edit.
    c) Press in Select mode initiates copy attribute function.
17) Record:
    a) First press: Activate record menu.
    b) Second press: Completes Record operation.
    c) Subsequent Go button: Appends to cue list.
    d) Subsequent Bump button: Records memory.
    e) Slide resistance potentiometers
18) Memory fader: Adjust programmed and active memory.
19) Playback master: Adjust programmed and active playlist.
20) Grand master: Adjust all intensities.
21) Memory master: Adjust all memory.

e. Digital rotary encoders
    1) One detent: One programmed unit.
    2) Shift with one detent: Smallest increment of program.

f. Software buttons
    1) Luminaire:
        a) Touch to select or deselect luminaire.
        b) Double touch to take luminaire to full intensity.
        c) Shift Touch to select a range of luminaires.
    2) Select mode
        a) Arrow: Change page.
        b) Par can: Change selected luminaire.
        c) Magnifying glass: Change quantity of luminaires displayed.
        d) Airplane: Switch pages.
        e) Number: Release selected luminaires.
        f) Filter: Display luminaires per selected attribute.
        g) Information: Expand luminaire information displayed.
    3) Control mode
        a) Intensity: Adjust intensity of selected luminaires.
        b) Color: Adjust color of selected luminaires.
        c) Position: Adjust position of selected luminaires.
        d) Shape: Adjust shape of selected luminaires.
    4) Record mode
        a) Memory: Record memory to select slider and bump button.
        b) Cue: Record sequential cue in playlist.
        c) Library: Record selected attribute for luminaire application.
        d) Group: Record selected luminaires as single entity.

5) Play mode
   a) Playback
      i. Play: Advance to next sequential cue in active playlist.
      ii. Back: Restore previous cue.
      iii. Pause: Pause fading cue.
      iv. Skip back: One second fade to previous cue.
      v. Skip forward: One second fade to next cue.
   b) Memory: Shows banks of 20 Memories
   c) Mixed: Move between Memories and Playlists
   d) Schedule: Astronomical/TimeClock

g. Program astronomic timeclock functionality:
   1) Time.
   2) Days.
   3) Sunrise, Sunset with offsets.

3. Graphical
   a. General:
      1) Show file quantity.
      2) Free disk space.
   b. Software buttons:
      1) Arrow.
      2) Par can.
      3) Magnifying glass.
      4) Airplane.
      5) Number.
      6) Filter.
      7) Information.
   c. Select task luminaire quantity display option:
      1) Ten.
      2) Twenty.
      3) Forty.
      4) Sixty.
      5) One hundred.
   d. Luminaire:
      1) Assigned number.
      2) Manufacturer.
      3) Model.
      4) Starting DMX address.
      5) Type name.
      6) Active intensity value.
      7) Active color value.
      8) Intensity status color
         a) Red: Programmer controlled.

b) Yellow: Memory controlled.
c) Cyan: Cue controlled increase.
d) Green: Cue controlled decrease.
e) Magenta: Cue controlled without change.

9) Attribute status color
a) Red: Programmer controlled.
b) Yellow: Memory controlled.
c) Blue: Cue controlled.
d) Magenta: Cue controlled without change.

e. Playlist:
1) Quantity of playlists.
2) Cue quantity.
3) Memory quantity.

f. Manufacturer's user guide:
1) Interactive table of contents.
2) Hyperlinked text.

4. Functional
a. Touch activation
1) Momentary.
2) Momentary and held modifier key.

b. Help system:
1) Provide overlay text to explain functionality.
2) Provide interactive graphical user guide.

c. Third-party USB storage device
1) Backup and save.
2) Reload save state.
3) Software updates via third-party computer.
4) Luminaire and device library updates via third-party computer.

d. Memory: A recorded state assigned to a slider and bump button.

e. Playlist: A grouping of recorded cues in sequential order for use with play mode.

5. Nonfunctional
a. Luminaire and device library
1) Pre-installed profile quantity: 3,722.
2) Pre-defined parameters for luminaire and device interface.

b. Maximum programming
1) Channels: 680.
2) Recorded cues: 10,001.
3) Show files: 999.

c. Internal timecode clock quantity: Three.

d. Timecode clock input quantity: One.

T. Manufacturers and Products

1. Basis of Design:

a. Pathway Connectivity
b. Chamsys

2. Supply the Following:

Qty	Model	Description
1	PWCOG DT S512	Cognito 2 Theatrical Console, Desktop, Starter 512 Channels
1		25’ DMX Cable
1		Carrying Case

1.14 DATA PLUG-IN STATIONS

U. General

1. The Plug-in Stations shall consist of the appropriate connectors required for the functional intent of the system. These stations shall be available with DMX input or output, Network, or architectural control connectors. Custom control connectors shall be available.

V. Connector Options

1. The following standard components shall be available for Plug-in Stations:
   a. 5-Pin male XLR connectors for DMX input
   b. 5-Pin female XLR connectors for DMX output
   c. RJ45 connectors for Network connections - Twisted Pair
2. Custom combinations and custom control connections shall be available.

W. Physical

1. Station faceplates shall be .80" aluminum, finished in fine texture, scratch-resistant black powder coat.
2. The station panel shall mount into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for contractor terminations.

1.15 POWER DISTRIBUTION – CONNECTOR STRIPS

X. The connector strips shall be the MegaBatten by the The Light Source or approved equal

Y. General

1. Connector strips shall provide distributed power form incoming circuits to plugs along a raceway
2. Internal wiring shall be sized to circuit ampacity and shall be rated at 125°C
3. Connector strips shall support a combination of line voltage power and low voltage data distribution within a single raceway.
4. Connector strips shall be listed by a nationally recognized test lab (NRTL). Connector strips that are not listed shall not be acceptable

Z. Physical

1. Connector strips shall be 1-1/2in schedule 80 Aluminum Pipe127mm H x 45mm D and fabricated from 1.6mm aluminum finished in black, white, or custom RAL.

2. Connector strips shall be available in any length up to 100ft in specified increments of 16in and shipped fully wired with all splicing hardware
3. Single device plate with power and data shall be supported every 16in.
4. Connector strips shall be supplied with appropriate brackets and hardware for mounting.
5. Connector strips shall support spans up to 8ft between hanger brackets

AA. Electrical

1. Connector strip shall support 120V/60Hz power input per branch circuit with support for multiple outlets wired to each circuit
2. The connector strip shall have multiple power input options supporting up to six 20A circuits:
   a. Wiring terminal box shall
   b. Extended intermal conductors with conduit ring to run inside flex or conduit to building junction box.
   c. 19 pin male circular connector
   d. Standard nema connectors on SO cable: 12/3, 12/4, or 12/5
3. Power output connectors shall be available as 20A Nema 5-20 Single Receptacle.
4. Terminations shall be consolidated at one end and utilize feed-through terminals individually labeled with corresponding circuit numbers
5. A low voltage data distribution system shall be supported to incorporate DMX/ RDM (ANSI E1.11-2008 USITT DMX512-A and ANSI E1.20 Remote Device Management)
   a. DMX output ports shall be 5 pin XLR, 3 pin XLR, or RJ45
   b. Low voltage signals shall enter the connector strip via a or connector mounted at the specified end of the connector strip.

1.16 WARM WHITE LED ERS-STYLE PRODUCT

BB. General

1. The product shall be an Ovation E-2FC as manufactured by Chauvet & Sons, LLC or approved equal.
   a. The product shall be high-intensity LED illuminator utilizing warm white LED’s and DMX control of intensity.
   b. The products shall conform to CSA C22.2 No. 166-15 and UL 1573 stage and studio use as well as UL 8750 LED standards, tested via MET to conform to the aforementioned UL specifications, product shall hold MET and CE markings.
   c. The product shall comply with the USITT DMX-512A standard.
   d. The product shall comply with the current PLASA ANSI E1.20-2010 remote device management standard.
   e. All LED products shall be provided by a single manufacturer to ensure color consistency.

CC. Physical

1. The product shall be constructed of rugged, die cast aluminum, free of defects or imperfections.

2. The following shall be provided:
   a. Lenses attached with silicone shock mounts.
   b. Shutter assembly shall allow for +/-25° rotation in either direction from the center position. Barrel rotation shall be secured by two thumb screws for tool free operation.
   c. 21-Gauge spring steel shutters
   d. Lens tubes shall be interchangeable for various beam/field angles utilizing polycarbonate guides for ease of focus. Lenses shall be secured with two thumb screws for tool free operation.
   e. Sturdy integral die cast gel frame holders with two accessory slots, and a top-mounted, quick release gel frame retainer.
   f. Rugged aluminum yoke with two mounting positions allowing 300°+ rotation of the product within the yoke.
   g. Product shall have double clutch yoke lock on each side of the product with ratcheting handles.
   h. Accessories slot with thumb screws for tool free access for optional accessories.
   i. Product shall contain a safety mounting point as an integral part of the casing.
3. The housing shall have a rugged black powder coat finish.
   a. White powder coat finish shall be available as a standard color option.
4. Power supply, cooling , and electronics shall be integral to each product.
5. The product shall ship with:
   a. Theatrical-style hanging yoke as standard.
   b. 5’ cable with Neutrik powerCON to Edison connector as standard

DD. Optical

1. The product shall provide, but not be limited:
   a. Low gate temperature
   b. Sharp imaging through a three-plan shutter design
2. The product shall have the following lens options available:
   a. 14, 19, 26, 36, and 50 HD lenses with fixed field angles as standard options.
   b. 15-30 and 25-50 degree HD lenses with variable field angles as standard options
3. Product optics shall provide:
   a. Sharp shutter cuts without halation.
   b. Shutter warping and burnout in normal use shall be unacceptable
   c. Adjustable hard and soft beam edges.
   d. High Definition lenses that provide high definition imaging shall be standard. Approved alternat products must provide lensing with comparable definition.

EE. Environmental and Agency Compliance

1. The product shall conform to UL 1573, CSA C22.2 No 166, and UL 8750 LED Standards, tested via MET to conform to aforementioned UL specifications, product shall hold MET and CE markings.
2. The product shall be rated for IP-20 dry location use.

FF. Thermal

1. Product heat management shall be achieved through active cooling via a low noise fam. Fan db rating shall not exceed 38.2db at a distance of 1 meter.
   a. Products exceeding 38.2db @1m shall not be allowed.
   b. Fan mode shall be selectable via on board menu or via RDM control.
2. The product shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 50,000 hours of use.
   a. Thermal management shall include temperature sensors within the housing to include:
   b. LED array circuit board temperatures.
   c. Product temperature shall be accessible with on board display or via RDM.
3. The product shall operate in an ambient temperature range of -20°C (-4°F) minimum, to 45°C (113°F) maximum ambient temperature.

GG. Electrical

1. The product shall be equipped with an auto-ranging 100-240V 50/60Hz internal power supply.
2. The product shall support power in and thru operation.
   a. Power in shall be via Neutrik powerCON input connector.
   b. Power through shall be via Neutrik powerCON output connector.
   c. Product power wiring and accessory power cables shall be rated to support linking of multiple products up to the capacity of a 15A breaker.
3. The product requires power from a non-dim source.
4. Products shall have thermal output compensation to prevent thermal shift of color or intensity.
5. Product power input shall have current limiting fuse protection.
6. Power supply shall have power factor correction.

HH. LED Emitters

1. The product shall contain a warm white LED color system to provide color characteristics as described in the Color section below.
2. All LEDs used in the product shall be high brightness and proven quality from established and reputable LED manufacturers.
   a. Product shall utilize Citizen LED emitters.
3. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.

4. LED emitters shall be rated for nominal 50,00-hour LED life at 70% intensity.
5. All LED products (100% of each lot) shall undergo a minimum of three-hour bun-in test during manufacturing.
6. LED system shall comply with all relevant patents.

II. Color

1. The product shall utilize a minimum of 1 LED light source.
   a. The light source shall be composed of one 90 Watt, warm white LED.

JJ. Dimming

1. The LED system shall use 16-bit nonlinear scaling techniques for high-resolution dimming.
2. The product shall have a selectable dimming curve to simulate incandescent dimming curves.
3. Dimming curve shall be optimized for smooth dimming over longer timed fades.
4. The LED system shall be digitally driven using high-speed pulse width modulation (PWM).
5. LED control shall be compatible with broadcast equipment in the following ways:
   a. PWM LED levels shall be imperceptible to video cameras and related equipment.
   b. PWM control shall be capable of being set via on board controls or via RDM to 600 Hz, 1,200 Hz, 2,000 Hz, 4,000 Hz, 6,000 Hz, or 25,000 Hz.

KK. Control and User Interface

1. The product shall be USITT DMX-512A compatible via in and through 5-pin XLR connectors and 3-pin XLR connectors.
2. The product shall be compatible with the ANSI RDM E1.20 standard.
   a. All product functions shall be accessible via RDM protocol for medication from suitable equipped control console or RDM controller.
   b. Temperature sensor within the luminaire shall be viewable in real time via RDM and on the control panel of the product.
   c. Products not offering RDM compatibility, feature set access or temperature monitoring via RDM shall not be allowed.
3. The product shall be equipped with an OLED display with 5 lines of text.
4. The product shall be equipped with a four-button user-interface.
5. A variable-rate strobe channel shall be provided.
6. The product shall offer stand-alone functionality, eliminating the need for a console.
   a. Product shall ship with 4 auto sequences with speed control accessible as a stand-alone feature.
   b. Product can be linked together with standard DMX cables and controlled from designated master product.

1) Up to 32 products may be linked.

c. Product shall offer one-button access to intensity control, to eliminate the need for a lighting console during hang/focus. Exiting this mode shall restore the product to standard DMX control.

d. Products without stand-alone operation features described above shall not be accessible.

LL. Manufacturers and Products

1. Basis of Design:
   a. Altman Lighting
   b. Chauvet Professional
   c. ETC
2. Each fixture to include safety, c-clamp, appropriate power cable, and appropriate DMX cable.

1.17 RGBA+L LED (Light Emitting Diode) PAR-style product

MM. GENERAL

1. The product shall be an Ovation P-56FC as manufactured by Chauvet & Sons, LLC or approved equal.
   a. The product shall be a color-mixing high-intensity LED illuminator utilizing 48 RGBAL LEDs using 3 to 5W and have DMX control of intensity and color.
   b. The products shall conform to CSA C22.2 No. 166 and UL 1573 stage and studio use as well as UL 8750 LED standards, tested via MET to conform to the aforementioned UL specifications, the product shall hold both MET and CE markings.
   c. The product shall comply with the USITT DMX-512 standard.
   d. The product shall comply with the current PLASA ANSI E1.20-2010 remote device management (RDM) standard.
   e. All LED products shall be provided by a single manufacturer to ensure color consistency.
2. Each LED optic shall be spaced for optimal photometric performance.

NN. PHYSICAL

1. The product shall be constructed of die-cast Aluminum, free of defects or imperfections.
2. The dimensions of the fixture shall be 12.48 x 12.83 x 14 in (317 x 326 x 363 mm) and weigh approximately 12.2 lbs (5.6 kg).
3. The following shall be provided:
   a. Ovation P-56FC fixture
   b. Neutrik powerCON power cord
   c. 7.5” Gel frame holder
   d. Medium and wide lenses
4. The housing shall have a black coat finish.
5. Power supply, cooling and electronics shall be integral to each product.

OO. ENVIRONMENTAL AND AGENCY COMPLIANCE

1. The product shall conform to UL 1573, CSA C22.2 No. 166, and UL 8750 LED standards, tested via MET to conform to the aforementioned UL specifications, the product shall hold both MET and CE markings.
2. The product shall conform to Part 15 of the FCC rules.
3. The product shall be rated for IP-20 for dry location use.

PP. THERMAL

1. Product heat management shall be achieved through forced cooling.
2. The product shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 50,000 hours of use.
3. The product shall operate in an ambient temperature range of -4°F (-20° C) minimum, to 113° F (45° C) maximum, ambient temperature.

QQ. ELECTRICAL

1. The product shall be equipped with an auto ranging 100 V to 240 V 50/60 Hz internal power supply.
2. The product shall support power in and thru operation.
   a. Power in shall be via Neutrik powerCON input connector.
   b. Power thru shall be via Neutrik powerCON output connector.
   c. Product power wiring and accessory power cables shall be rated to support linking of 9 products at 120V.
3. The product requires power from a non-dim source.
4. Products shall have thermal output compensation to prevent thermal shift of color or intensity.
5. Product power input shall have current-limiting fuse protection.
6. Power supply shall have power factor correction.

RR. OPTICAL DATA

1. The product shall contain a 5 color LED color system to provide color characteristics as described in the Color section below.
2. All LEDs used in the product shall be high brightness and proven quality from established and reputable LED manufacturers.
3. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.
4. LED emitters should be rated for nominal 50,000-hour LED life to 70% intensity.
5. All LED products (100% of each lot) shall undergo a minimum three-hour burn-in test during manufacturing.
6. LED system shall comply with all relevant patents.

SS. COLOR

1. The product shall utilize a minimum of 48 3 W to 5 W LED emitters.
   a. These emitters shall be composed of 10 Red, 10 Green, 8 Blue, 8 Amber, and 12 Lime LEDs.
2. The color rendering index (CRI) shall be: 89.9 at 3199° K and 84.6 at 5605° K.

3. The product shall be able to provide TM 30-18 scores with a Color Fidelity value of Rf 88.9 with a Gamut of Rg 107.2 at 3199° K and a Color Fidelity value of Rf 84.7 with a Gamut of Rg 104.8 at 5605° K.
4. The color temperature shall be 2800° K to 6500° K.

TT. DIMMING

1. The LED system shall use 16-bit nonlinear scaling techniques for high-resolution dimming.
2. The product shall have a selectable dimming curve to simulate incandescent dimming curves.
3. Dimming curve shall be optimized for smooth dimming over longer timed fades.
4. The LED system shall be digitally driven using high-speed pulse width modulation (PWM).
5. LED control shall be compatible with broadcast equipment in the following ways:
   a. PWM control of LED levels shall be imperceptible to video cameras and related equipment.
   b. PWM shall be capable of being set on the control via on board controls or via RDM from 600 Hz, 1,200 Hz, 2,000 Hz, 4,000 Hz, 6,000 Hz, or 25,000 Hz.

UU. REQUIRED FEATURE SET

1. The product shall offer interchangeable lens plates with medium and wide lens options.
2. The product shall accept 7.5” beam shaping accessories.
3. The product shall offer 4 user selectable fan modes.
4. The product shall have a maximum noise level of 37.8 dB measured at 1 m.
5. The product shall offer 9 DMX personality modes.
6. The product shall offer 10 Color Temperature Presets selectable via DMX or user interface.
7. The product shall offer 31 Color Presets using the Virtual Color Wheel and shall be selectable via DMX or user interface.
8. The product shall offer Red Shift ability selectable via DMX or user interface.
9. The product shall offer 4 user selectable Dimmer Curves.
10. Products without the required feature set described above shall not be acceptable.

VV. CONTROL AND USER INTERFACE

1. The product shall be USITT DMX 512A-compatible via in and thru 3- and 5-Pin XLR DMX connectors.
2. The product shall offer control via DMX and RDM.
3. The product shall be compatible with the ANSI RDM E1.20 standard.
   a. All product functions shall be accessible via RDM protocol for modification from suitably equipped control console or RDM controller.

b. Temperature sensor within the luminaire shall be viewable in real time via RDM and on the control panel of the product.
c. Products not offering RDM compatibility, feature set access or temperature monitoring via RDM shall not be allowed.

4. The product shall be equipped with a LED display with 5 lines of text.
5. The product shall be equipped with a 4-button user-interface.
6. The product shall offer RGBAL direct and single channel control.
7. A variable-rate strobe channel shall be provided.
8. The product shall offer stand-alone functionality eliminating the need for a console.
   a. Product shall ship with 31 preset colors accessible as a stand-alone feature.
   b. Product shall ship with 5 auto sequences with speed control accessible as a stand-alone feature.
   c. Product can be linked together with standard DMX cables and controlled from designated master product.
   d. Products without stand-alone operation features described above shall not be acceptable.

WW. Manufacturers and Products

1. Approved Manufacturers:
   a. Altman Lighting
   b. Chauvet Professional
   c. ETC
2. Each fixture to include safety, c-clamp, appropriate power cable, and appropriate DMX cable.

1.18 C-Clamps

XX. All C-clamps shall be permanently marked with a load rating. Cast C-clamps are not acceptable.

YY. Approved Manufacturers

1. The Light Source
2. Apollo Design

1.19 DMX Cables

ZZ. Theatrical Integrator responsible for appropriate length

AAA. 5 Pin XLR Connectors

BBB. Heavy-duty cable construction intended for use as a portable data cable in a stage environment

CCC. Approved Manufacturers

1. LEX
2. TMB
3. Blizzard
4. Chauvet

Execution

1.20 Installation of Theatrical Lighting System

DDD. It shall be the responsibility of the Electrical Contractor to receive and store the necessary materials and equipment for installation of the dimmer system. It is the intent of these specifications and plans to include everything required for proper and complete installation and operation of the dimming system, even though every item may not be specifically mentioned. The contractor shall deliver on a timely basis to other trades any equipment that must be installed during construction.

EEE. The electrical contractor shall be responsible for field measurements and coordinating physical size of all equipment with the architectural requirements of the spaces into which they are to be installed.

FFF. The electrical contractor shall install all lighting control and dimming equipment in accordance with manufacturers approved shop drawings.

GGG. All branch load circuits shall be live tested before connecting the loads to the dimmer system load terminals.

1.21 SYSTEM COMMISSIONING AND TRAINING

HHH. General

1. Prior to operational checkout, the Electrical Contractor shall confirm the following conditions.
   a. All control stations are installed and terminated per the vendor's integration drawings.
   b. Availability of owner's staff for instruction
   c. Space is clear of workmen and may be blacked out for extended periods
   d. Building and equipment feeders are energized
   e. HVAC systems are operational in Control Booths and Dimmer Equipment Spaces
   f. Stage luminaries are installed and connected to the dimming system to confirm that individual dimmed circuits are in operational order
   g. Dimmer rack and all equipment is cleaned and ready for operational check-out.
2. Notify vendor in writing, at least 21 days prior to requested startup date, that the system is ready for startup.
3. Costs of additional or repeat visits due to delay, lateness, or negligence on the part of the Electrical Contractor shall be borne by the Electrical Contractor.

III. Testing

1. The vendor's Field Service Representative shall complete the following:
   a. Inspect the Electrical Contractor's installation for conformance to vendor's instructions.
   b. Confirm all wiring runs and termination and make notes as required.

c. Make notes and diagrams as needed for completion of As-Built Documents as specified elsewhere in this section. Make note of any deviations from vendor's directions

d. Measure incoming voltages at the relay rack and record

e. Configure relay rack, console, stations and other components for proper operation.

f. Test each wired space of relay rack for proper operation

g. Test all control stations, consoles and auxiliary controls for proper operation.

h. Replace any equipment not operating as specified.

JJJ. Training

1. A factory certified representative of the vendor shall instruct the Owner's staff or representatives in the operation and maintenance of the system. This instruction session shall be scheduled to last a minimum of four (4) hours. While it may be possible to schedule this instruction session to coincide with the system checkout, such coincidence shall not be assumed.

END OF SECTION 26 55 61

SECTION 27 06 10 - VOICE/DATA SYSTEM/VIDEO COMMUNICATIONS SYSTEMS

PART 1 - GENERAL SPECIFICATIONS

1.1 RELATED DOCUMENTS

A. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.

B. The use of proprietary or copyrighted names or reference to patented trade items within this specification or elsewhere in the Contract Documents is meant to establish a standard of quality and performance. In no way does such use establish a restrictive competitive bidding situation, or exclude materials or equipment that is truly equivalent to the standard of quality. All materials and equipment proposed for installation must meet or exceed all specified requirements and be approved. Known equals are listed, but will require cut sheets with performance parameters to be submitted for final approval at least 10 days prior to bid.

1.2 SUMMARY

A. Section Includes:

1. Work Area Outlets
2. 110 Copper Termination Block & Patch Panels
3. Racks, Cabinets and Cable Management
4. Horizontal Distribution Cable
5. Backbone & DAS Cabling Cable
6. Fiber Optic Termination Hardware
7. Pathways & Penetrations
8. Audio Visual Infrastructure
9. Power (UPS and PDU)
10. Grounding and Bonding
11. Copper Cable Protection Units
12. Firestopping
13. Cable System Identification System

1.3 SCOPE OF WORK

A. The intent of this specification section is to cover the materials and installation of a structured cabling system and termination equipment as outlined herein and as detailed on the drawings. Work shall consist of

1. Work area outlets including faceplates, jacks (voice, data, CATV, A/V), and labels. Boxes and conduit are being provided by Div 26 contractor.

2. Voice and data copper station cabling from work area outlets to telecommunications rooms including termination testing and labeling.
3. Voice and data work area equipment cords.
4. Voice and data horizontal cross-connect jumpers and patch cables including labeling.

B. System Description -- Voice and Data station cabling (copper) system shall consist of:
1. Workstation outlet jacks.
2. Voice and data station cabling as specified herein from each workstation outlet to the termination equipment located in the Main Distribution Frame (MDF) or the Intermediate Distribution Frame (IDF).
3. Station Cable Termination Equipment in each MDF and IDF.
4. Final connections of the station cabling at the workstation outlet jack and the termination equipment in each MDF and IDF.
5. Cross connects / patch cable to connect work area outlets to backbone / network electronics.
6. Testing and labeling.

1.4 REGULATORY REFERENCES:

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.

B. All materials shall be UL or ETL Listed and shall be marked as such. If UL/ETL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL/ETL has an applicable system listing and label, the entire system shall be so labeled.

C. All modular jacks, patch cords, consolidation point, and patch cords performance shall be verified (not just tested) by a third party to be category 6 (or 6A) component and channel compliant.

D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:

1. ANSI/TIA-568.0-D, Generic Communications Cabling for Customer Premises, September 2015
2. ANSI/TIA-568.1-D, Commercial Building Communications Infrastructure Standard September 2015
3. ANSI/TIA-568.2-D, Balanced Twisted-Pair Telecommunications Cabling and Components Standard, September 2018
4. ANSI/TIA-568.3-D, Optical Fiber Cabling Components Standard, September 2016
5. ANSI/TIA–569-D, Telecommunications Pathways and Spaces, November 2015
6. ANSI/TIA–606-C, Administration Standard for Communications Infrastructure, June 2017

7. ANSI/TIA–607-C, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, November 2015
8. ANSI/ TIA–758-B, Customer-Owned Outside Plant Telecommunications Infrastructure Standard, March 2014.
9. ANSI/TIA-1179-~~A, Healthcare~~A, Healthcare Facilities Telecommunications Infrastructure Standard, August 2017
10. BICSI - TDMM, Building Industries Consulting Services International, Communications Distribution Methods Manual (TDMM) – 13th Edition.
11. National Fire Protection Agency (NFPA – 70)
12. FCC 47 CFR 68
13. NEMA 250
14. NEC 2017
15. ADA, Americans with Disabilities Act

E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

1.5 APPROVED VENDORS

A. The Installation Vendors (Contractors) must at a minimum possess the following qualifications:

1. Be in business a minimum of five (5) years.
2. Shall demonstrate satisfaction of sound financial condition and shall be adequately bonded and insured per owner's requirements.
3. Possess those licenses/permits required to perform communications installations in the specified jurisdiction
4. Personnel knowledgeable in local, state, province and national codes and regulations. All work shall comply with the latest revision of the codes and regulations. When conflict exists between local and national codes or regulations, the most stringent codes or regulations shall be followed.
5. Must possess and provide proof of current owners insurance certificates
6. Installers with RCDD on staff are preferred, at least one BICSI certified technician required.
7. Must have prior experience with this type of installation or work activity. The customer may, with full cooperation of the contractor, visit client installations to observe equipment operations and consult with references. Specified visits and discussion shall be arranged through the contractors; however, the contractor's personnel shall not be present during discussions with references. The contractor must provide a minimum of three (3) references of similar jobs, one within the past 6 months and one at least 3 years ago where the same solution was installed.

8. Documentation of ALL certifications to be provided in bid package
9. Outside Plant Projects – will be done by pre approved vendor according to demographic and size of project

1.6 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:

1. Furnish and install a complete telecommunications wiring infrastructure.
2. Furnish, install, and terminate all UTP and Optical Fiber cable
3. Furnish and install all wall plates, jacks, patch panels, and patch cords (as required by the owner's IT department).
4. Furnish and install all required cabinets and/or racks as required and as indicated.
5. Furnish any other material required to form a complete system.
6. Furnish and install j-hooks where needed for the horizontal distribution
7. Furnish and install all materials to build out the MDFs/IDFs as depicted on drawings
8. Telecommunications contractor is responsible for the basket tray in MDFs/IDFs. The basket tray for the horizontal distribution may be done by or in coordination with the electrical contractor
9. Perform link testing (100% of horizontal and/or backbone links/channels) and certification of all components.
10. Furnish test results of all cabling to the owner electronically, listed by each closet, then by workstation ID.
11. Adhere and comply with all requirements of Manufacturer Certification.
12. Provide owner training and documentation. (Testing documentation and As-built drawings)

1.7 SUBMITTALS

A. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:

1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
3. No substitutions/alternatives from the manufacturers listed in this document will be permitted. No substituted materials shall be installed except by written approval.
4. Product Data: For each type of product indicated.

a. Submittals shall include manufacturer's data sheets (cut sheets) and be accompanied by a detailed bill of material, including part numbers and quantities.

5. Shop Drawings:
   a. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
   b. Wiring diagrams to show typical wiring schematics including the following:
      1) Cross-connects.
      2) Patch panels.
   c. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
   d. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
      1) Vertical and horizontal offsets and transitions.
      2) Clearances for access above and to side of cable trays.
      3) Vertical elevation of cable trays above the floor or bottom of ceiling structure.
      4) Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
6. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
7. Source quality-control reports.
8. Field quality-control reports.
9. Maintenance Data: For connectors to include in maintenance manuals.

B. Work shall not proceed without the Owner's approval of the submitted items.

1.8 QUALITY ASSURANCE

A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not. All installers must be employees of the contractor.

1.9 DELIVERY, STORAGE AND HANDLING

A. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from theft, vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.

B. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

1.10 DRAWINGS

A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.
B. The contractor shall verify all dimensions at the site and be responsible for their accuracy.
C. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work

1.11 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers.
   1. Meet jointly with telecommunications and LAN equipment suppliers, Engineer, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
   2. Record agreements reached in meetings and distribute them to other participants.
   3. Adjust arrangements and locations of racks, sleeves, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of utility demarcation, telephone and LAN equipment.
B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 EQUIVALENT PRODUCTS

A. Due to the nature and type of communications all products and solutions in this document have a standard of quality listed. Substitutions are listed, but products MUST demonstrate performance equivalency.

2.2 WORK AREA OUTLETS

A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.

B. The Telecommunications Outlet Assembly shall accommodate:
   1. A minimum of two (2) modular jacks unless specified. Additional copper cables as necessary.
   2. A blank filler will be installed when extra ports are not used.

3. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation.
4. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA–606-C standard specifications. **Hand printed labels shall not be accepted.**

C. Faceplates: Standard of quality is Legrand Part # OR-403HDJ14 (4 port) or OR-403HDJ12 (2 port) for general work area outlets. Standard of quality for phone hanger faceplates is Legrand Part # WMTE14W (1 port) Phone Mount Faceplate The faceplates shall:
   1. Be of the style as appropriate to fit the modular jack used.
   2. Have mounting screws located under recessed designation windows.
   3. Comply with ANSI/TIA 606-C work area labeling standard.
   4. Workstation Outlets: Connector assemblies mounted in faceplate. Provide number of ports as shown on the Drawings.
   5. Retain one of first two subparagraphs below, or retain both as required to match Division 26 Section "Wiring Devices."
   6. Plastic Faceplate: High-impact plastic.
   7. For use with snap-in jacks accommodating any combination of UTP, F/UTP, optical fiber, and coaxial work area cords.
   8. Acceptable substitutions are Systimax and Panduit

D. Voice / Data Jacks: Standard of quality is Legrand Cat 6 for voice/data; Cat 6A for wireless access points and security cameras/camera equipment.

   1. Cat 6 Jacks: 100-ohm, unshielded balanced, twisted-pair connector; four-pair, eight-position modular. Comply with ANSI/TIA-568.2-D up to 250 MHz.
   2. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
   3. The modular jack shall be backwards compatible to Category 3, 5, and 5e.
   4. The modular jack shall be center tuned to category 6 test specifications.

Part Number	Description
OR-HDJ6-36	Legrand Category 6 T568A/B High Density (HD) Jack Blue (Data)
OR-HDJ6	Legrand Category 6 T568A/B High Density (HD) Jack Fog White (Voice)
OR-HDJ6 - xx	xx - Refer to systems plans for breakdown of systems by color. Final color to be selected by the architect.

   5. **Cat 6A jacks (qty 2) to be used for each Wireless Access Points and Security Cameras**
      (to accommodate for speeds in excess of 1 Gigabit transmission, or cameras with dual-input provisions).

6. Jacks: 100-ohm, unshielded balanced, twisted-pair connector; four-pair, eight-position modular. Comply with ANSI/TIA-568.2-D up to 500 MHz.
7. The modular jack shall be backwards compatible to Category 3, 5e and 6.
8. The Wireless Access Point jacks shall be terminated in a 2-port surface mount box.
9. The modular jack shall be center tuned to category 6A test specifications.

Part Number	Description
OR-HDJ6A-43	Legrand Category 6A T568A/B High Density (HD) Jack Orange (Wireless Access Points)

10. Acceptable substitutions are Systimax and Panduit

2.3 110 COPPER TERMINATION BLOCK

A. The voice cross connect shall be a passive connection between the horizontal termination blocks and the backbone termination blocks. The wall mount frames shall be field terminated kits including all blocks, connecting blocks, and designation strips.

B. Management rings shall be mounted between vertical columns of blocks to provide management of cross-connect wire.

C. Backbone and horizontal blocks shall use 4-pair connecting blocks. Blocks shall be oriented so that backbone terminations are located on the left and horizontal frames are located on the right of the termination field when facing the frame assembly.

D. Standard of quality: Legrand

E. 110 Block Kits shall:
   1. include both the wiring block in a 50, 100 and 300 pair footprint and the connecting block C6110C5
   2. be manufactured using fire retardant molded plastic.
   3. support termination of 22-24 AWG solid conductor
   4. wiring block shall contain back openings for the feed through of cable
   5. have color-coded tips on the wiring block and color coding on the connector blocks for installation identification.
   6. shall use standard termination practice requiring a single conductor 110 impact tool
   7. have termination hardware that maintains the paired construction of the cable to facilitate minimum untwisting of the wires.
   8. be backwards compatible to category 3, 5 and 5e

F. 110 Cross-Connect System Backboard Channels Shall
   1. be available in 300 and 900 pair sizes.
   2. allow the mounting of 110 100-pair blocks without legs.
   3. include bottom trough and grounding bar.

4. be wall mountable.
5. be of cold roll steel construction.

G. 110 Wall Mount Vertical Trough Shall
1. be available in single channel or dual channel configurations.
2. in dual channel configuration shall be used to provide separation for different wiring media.
3. be available in 300 pair and 900 pair sizes.
4. be wall mountable.
5. be used with wall mountable backboard channels. Acceptable configurations include a 300 pair and a 900 pair.
6. be of cold roll steel construction.

Note: Project may require horizontal analog and backbone cables to be terminated on patch panels in IDF/MDF's. Contact Telecom Representative for details.

2.4 MODULAR PATCH PANELS

A. The Modular Patch Panels shall
1. meet category 6 or 6A component compliance and be verified by a third-party nationally recognized independent testing laboratory
2. be backward compatible to category 3, 5 and 5e
3. be center tuned to category 6 or 6A test specifications
4. Standard of Quality is Legrand

Part Number	Description
OR-PSAHJU48	48 Port unloaded 2RU Angled Panel (for HD Jacks)

5. Acceptable Substitutions are Systimax or Panduit

2.5 RACKS, CABINETS, AND CABLE MANAGEMENT

The equipment rack shall provide vertical cable management and support for the patch cords at the front and back of the rack. Waterfall cable management shall be provided at the top of the rack to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack.

A. Free-Standing Rack shall:
1. provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA 568-D.
2. provide pre-drilled base for floor attachment of rack.
3. be available in standard color of black or white.
4. Provide channels with 10" depth for routing of horizontal cable

5. Standard of quality for 2 and 4 post racks shall be Legrand.

Part Number	Description
OR-MM20710-B	Black 2 Post Rack, 7’ high with 10” channel depth
OR-MM20742ADJ12-B	Adjustable 4 Post MM Rack, 7’ high with tapped mounting holes
OR-MM20742ADJ38-B	Adjustable 4 Post MM Rack, 7’ high with square mounting holes

6. Acceptable substitutions are Tripp Lite and Middle Atlantic

B. The vertical and horizontal cable management shall be utilized and installed with the 2 and 4 post racks.
   1. They shall include snap on covers/doors that can swing either direction.
   2. Standard of quality for cable management shall be Legrand MM20 for vertical and SHMC series for horizontal.

Part Number	Description
OR-MM20VMD706-B	Single Sided 6” Vertical Cable Management with door, 6” W x 10.25” D x 7’ H (for end of row or single racks)
OR- MM20VMD710-B	Single Sided Vertical Cable Management with door,10.5” W x 15”D x 7’ H (for between racks)
OR-SHMC2RU	2U Horizontal cable manager to be used between patch panels and/or switch gear
OR-SHMC4RU	4U Horizontal cable manager to be used to pass patch cords from one side of the rack to the other

3. Acceptable substitutions are Tripp Lite and Middle Atlantic

C. Wall Mounted Cabinet shall:
   1. provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA 568-D.
   2. have wall mount braces with locator posts for easy wall mounting.
   3. have side access points that allow for access to manage/install distribution cables in the vertical channels.
   4. be lockable.
   5. contain integrated vertical cable management
   6. The standard of quality for wall mount cabinet shall be Legrand:

Part Number	Description
SWM12RUPL-26-26	26”W x 25”H x 28”D, plexi-glass door 12 RU; 200 lbs*
SWM26RUPL-26-26	26”W x 28”D x 49.5”H, plexi-glass door 26 RU; 300 lbs*

*weight capacity

7. Acceptable substitutions are Tripp Lite and Middle Atlantic

D. Free-Standing Cabinet shall have full flat mesh front door with locking swing handles
   1. Standard of quality is Legrand

Part Number	Description
OR-QC422442	Legrand Server Cabinet, free-standing, 42U, 24" W, 42"D, with side panels (cabinet accessories to be specified)
OR-QC422942	Legrand Network Cabinet, free-standing, 42 RU, 29.5" W, 42" D with side panels (cabinet accessories to be specified).

   2. Acceptable substitutions are Middle Atlantic and Tripp Lite

2.6 HORIZONTAL DISTRIBUTION CABLE

A. All horizontal data station cable and voice cable shall terminate on modular patch panels (copper), or patch/splice cabinets (fiber) in their respective MDF or IDF as specified on the drawings.

B. Category 6 cable will be utilized for standard voice and data drops, and Category 6A cable will be utilized for wireless access points.

C. Copper or fiber cable that offers EPDs (Environmental Product Declaration) and / or HPDs (Health Product Declaration) to apply toward LEED certification are PREFERRED.

   1. Products covered by EPDs and HPDs contribute towards one (1) point each in the Material and Resources credit (MRc) category for projects pursuing those credits

   2. Products that have both EPDs and HPDs will effectively contribute towards two (2) separate credits in the MR category

D. 100 OHM Category 6 UTP with fire-resistant thermoplastic jacket **with separator or divider** between pairs.

   1. Physical Characteristics:
      a. Plenum
         1) Insulation FEP
         2) Jacket: FR, low smoke PVC
         3) Nominal Velocity of Propagation: 73
      b. Non Plenum
         1) Insulation: Polyolefin
         2) Jacket: FR PVC
         3) Nominal Velocity of Propagation: 70
      c. Solid annealed copper conductors
      d. 23 AWG copper conductors

e. Low-dielectric thermoplastic insulation
f. Pair-separator for improved performance
g. Characteristic Impedance: 100 ± 15 Ohms
h. Comply with UL 444
i. Comply with NFPA 262
j. Comply with ICEA S-90-661 for mechanical properties.
k. Comply with ANSI/TIA-568.2-D for Category 6 UTP cables.
l. Verified for Category 6 performance by an NRTL
m. RoHS compliant materials

2. Performance Characteristics:
   a. Guaranteed electrical performance up to 400 MHz
   b. Guaranteed 3 dB margin over ANSI/TIA-568.2-D requirements for NEXT and PSNEXT
   c. Guaranteed 4 dB margin over ANSI/TIA-568.2-D calculated requirements for ACR and PSACR
   d. Printed with unique alpha-numeric code for each package of product
   e. Printed in both feet and meters with the units of length decrementing to indicate the amount of cable remaining in the box.
   f. Tip colors shall be a lighter version of the ring color.
   g. **4 pair UTP for Wireless Access Points for speeds in excess of 1 Gigabit transmission (see section F for 6A specification)**: Cat 6A with isolation wrap (no ground required) or actual shield (needs grounding).

3. Design Make:

   a. Standard of quality for Cat 6 is Superior Essex Datagain Cat 6 enhanced UTP.

Plenum Part Number	Description
66-240-2B	Data / Blue / CMP
66-240-4B	Voice / White CMP

Non-Plenum Part Number	Description
66-240-2A	Data / Blue / CMR
66-240-4A	Voice / White CMR

E. 100 OHM Category 6A UTP with fire-resistant thermoplastic jacket with separator or divider between pairs and isolation wrap.

1. Physical Characteristics:
   a. Plenum
      1) Insulation FEP
      2) Jacket: FR, low smoke PVC
      3) Nominal Velocity of Propagation: 73
   b. Non Plenum
      1) Insulation: Polyolefin
      2) Jacket: FR PVC
      3) Nominal Velocity of Propagation: 70

c. Solid annealed copper conductors
d. 23 AWG copper conductors
e. Low-dielectric thermoplastic insulation
f. Pair-separator for improved performance
g. Characteristic Impedance: 100 ± 15 Ohms
h. Comply with UL 444
i. Comply with NFPA 262
j. Comply with ICEA S-90-661 for mechanical properties.
k. Comply with ANSI/TIA-568-C.2 for Category 6A UTP cables.
l. Verified for Category 6A performance by an NRTL
m. RoHS compliant materials

2. Performance Characteristics:
   a. Guaranteed electrical performance up to 400 MHz
   b. Guaranteed 3 dB margin over ANSI/TIA-568.2-D requirements for NEXT and PSNEXT
   c. Guaranteed 4 dB margin over ANSI/TIA-568.2-D calculated requirements for ACR and PSACR
   d. Printed with unique alpha-numeric code for each package of product
   e. Printed in both feet and meters with the units of length decrementing to indicate the amount of cable remaining in the box.
   f. Tip colors shall be a lighter version of the ring color.
   g. 4 pair UTP for Wireless Access Points for speeds in excess of 1 Gigabit transmission: Cat 6A with isolation wrap (no ground required) or actual shield (needs grounding).

3. Design Make:
   a. Standard of quality for Cat 6A Superior Essex 10GainXP Plenum (CMP) UTP w/ isolation wrap

Plenum Cat 6A Part #	Description
6H-272-2B	Wireless / Blue / CMP

Non-Plenum Cat 6A Part #	Description
6H-272-2A	Wireless / Blue / CMR

   b. Acceptable Substitutions are Panduit or Systimax

2.7 BACKBONE CABLE

A. Intrabuilding multipair unsheilded twisted pair

1. General purpose 25 pair plenum Cat 5e (Superior Essex cmp part #51-478-48)
2. For higher pair counts when Cat 3 is acceptable; 100 pair category 3 plenum unshielded twisted pair (Superior Essex Category 3 cmp part number 18-799-36) may be used.

B. Fiber Optic Cables

1. Fiber cable that offers EPDs (Environmental Product Declaration) and / or HPDs (Health Product Declaration) to apply toward LEED certification are PREFERRED.

2. Products covered by EPDs and HPDs contribute towards one (1) point each in the Material and Resources credit (MRc) category for projects pursuing those credits

3. Products that have both EPDs and HPDs will effectively contribute towards two (2) separate credits in the MR category

4. **Multimode:** Armored Optical Fiber Plenum (OFCP) Tight Buffered With 10 Gigabit OM4 Laser Optimized 50/125 Optical Fibers
   a. Each Multimode Fiber shall be:

      1) Graded-index optical fiber wave-guide with nominal 50/125µm-core/cladding diameter.
      2) The fiber shall comply with the latest revision of ANSI/TIA-492AAAC.
      3) Attenuation shall be measured in accordance with ANSI/TIA-455-78.
      4) Information transmission capacity shall be measured in accordance with ANSI/TIA-455-204 or –455-220.
      5) The measurements shall be performed at 23°C ± 5°C.
      6) Maximum attenuation dB/km @ 850/1300 nm: 3.5/1.5
      7) Bandwidth: 1500 MHz-km @ 850nm for overfilled launch,
      8) Bandwidth 500 MHz-km @ 1300nm.
      9) Optical Fiber shall be laser optimized and guaranteed for 40/100 Gigabit Ethernet distances of 100 meters
      10) Optical Fiber shall be laser optimized and guaranteed for 10 Gigabit Ethernet distances of 300m/300m for 850nm and 1300nm respectively
      11) Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of 1000m/600m for 850nm and 1300nm respectively

   b. Physical Characteristics:

      1) Shall be suitable for use in indoor applications.
      2) Shall be suitable for use in risers, plenums and horizontal applications.
      3) Shall be available with a fiber strand count range from 6 to 144.
      4) Shall meet NFPA 626
      5) Shall comply with Telcordia GR-409.
      6) Shall comply with the requirements of ICEA S-83-596.
      7) Buffered fibers shall be color coded in accordance with TIA-598 with an overall aqua jacket.
      8) Shall have a central strength member
      9) Suitable for operation between -20°C to +75°C
      10) Shall meet UL 1569, UL 1651
      11) Shall be RoHS compliant
      12) Shall have spiral wrapped aluminum armor and outer jacket

c. Design Make:

1) Standard of quality for Premise Distribution optical fiber cable with OM4 laser optimized 50/125 micron multi mode fiber is Superior Essex, part numbers below:

Part Number	Description
L4012N401	12 strand armored laser optimized 50 micron multi mode
L4024NK1Q	24 strand armored laser optimized 50 micron multi mode
L4048N401	48 strand armored laser optimized 50 micron multi mode

2) Acceptable Substitutions are Systimax and Corning

5. Single Mode: Armored Optical Fiber Plenum (OFCP) Tight Buffered With Enhanced (Low Water Peak) Single-mode Optical Fibers

a. Each Single-mode Fiber shall be:
1) Class IVa dispersion - unshifted single mode optical fibers with Low Water Peak complying with ANSI/ TIA-492CAAB-2000.
2) The zero dispersion wavelength shall be between 1300 nm and 1320 nm. The ANSI/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.090 ps/km-nm^2. Dispersion measurements shall be made in accordance with ANSI/TIA-455-169 or ANSI/TIA-455-175-B.
3) The nominal mode field diameter shall be 9.1 µm with a tolerance of ± 0.4 µm at 1310 nm when measured in accordance with ANSI/TIA-455-191-B.
4) Transmission Characteristics:
5) Maximum cabled attenuation dB/km @ 1310/1550 nm: 0.7/0.7
6) The cabled cutoff wavelength shall be ≤1260 nm when measured in accordance with ANSI/TIA-455-80-C
7) Distance vs. bandwidth using a Laser transmitter operating at a 1310 nm wavelength

b. Physical Characteristics:
1) Shall be suitable for use in indoor applications.
2) Shall be suitable for use in risers, plenums and horizontal applications.
3) Shall be available with a fiber strand count range from 6 to 144.
4) Shall comply with Telcordia GR-409.
5) Shall comply with the requirements of ICEA S-83-596.
6) Buffered fibers shall be color coded in accordance with TIA-598 with an overall yellow jacket.
7) Shall have a central strength member
8) Suitable for operation between -20°C to +75°C
9) Shall meet UL 1569, UL 1651
10) Shall have spiral wrapped aluminum armor and outer jacket

c. Design Make:
   1) Standard of quality for Armored Plenum Single Mode Low Water Peak is Superior Essex

Superior Essex Part Numbers

Part Number	Description
L4012K401	12 strand, Single-Mode armored plenum optical fiber
L4024KK1Q	24 strand, Single-Mode armored plenum optical fiber

   2) Acceptable Substitutions are TE Connectivity, Systimax and Corning

C. DAS (Distributed Antenna System)

1. Regardless of which DAS active equipment is to be installed, (Andrews, Mobile Access, Tyco Electronics, etc) standard of quality for copper 6A or helix copper DAS cabling & connectors as well as fiber shall be Superior Essex & Legrand.
2. DAS Integrator will be required to work with **certified cabling** contractor for pulling of and termination of all DAS copper and fiber cabling infrastructure.

   a. RF Feeder Infrastructure

      1) Cable
         a) LHF Series – Low Loss High Flexible Foam Dielectric
         b) HFSC Series – Super Flexible Foam Dielectric
         c) FTTA – Fiber to the Antenna

      2) Jumpers
         d) Available in ⅜ inch and ½ inch diameters, jumper cables are used in areas that require extremely small bending radius, such as between main feeders and antennas or between main feeders and RF equipment

      3) Connectors
         e) DIN Series for LHF and HFSC
         f) N Series for LHF and HFSC

   b. In Building Infrastructure

      1) Cable – Available in Plenum or Riser
         g) DAS Hybrid – Fiber + Copper
         h) LHF Riser – Low Loss High Flexible Foam Dielectric
         i) LHF Plenum – Low Loss High Flexible Air Dielectric
         j) HFSC Riser – Super Flexible Foam Dielectric
         k) HFSC Plenum – Super Flexible Air Dielectric

      2) Jumpers Available in Plenum or Riser
         a) Available in ½ inch diameters, jumper cables are used in areas that require an extremely small bending radius between main feeders and antennas or between main feeders and RF equipment.

3) Connectors
   a) DIN Series for LHF and HFSC
   b) N Series for LHF and HFSC

2.8 OUTSIDE PLANT FIBER OPTIC CABLE

Single Mode: Indoor/Outdoor Single Mode Loose Tube Optical Fibers

a. Each Single-mode Fiber shall:
   1. Meet or exceed ANSI/TIA-568.3-E
   2. The nominal mode field diameter shall be 9.1 µm with a tolerance of ± 0.4 µm at 1310 nm when measured in accordance with ANSI/TIA-455-191-B.
   3. Have the Following Transmission Characteristics:
      a. Maximum cabled attenuation dB/km @ 1310/1550 nm: 0.7/0.7
      b. The cabled cutoff wavelength shall be £1260 nm when measured in accordance with ANSI/TIA-455-80-C

b. Physical Characteristics:
   1. Shall be suitable for use in indoor and outside plant applications.
   2. Shall be available with a fiber strand count range up to 48 fibers.
   3. Buffered fibers shall be color coded in accordance with TIA-598
   4. Shall have a central strength member
   5. Suitable for operation between -40°C to +75°C
   6. Shall meet UL 1651, UL 1666

c. Design Make:
   1. Standard of quality Superior Essex EnduraLite Indoor/Outdoor, Loose Tube

2.9 FIBER OPTIC TERMINATION HARDWARE

A. FIBER OPTIC ENCLOSURES
   1. Fiber optic termination hardware is rack mountable, lockable, and holds various coupler panels based on density requirements.
   2. Fusion Splicing (splice cassettes, pigtails, or splice on connectors) shall be the preferred termination style for any new installations, unless otherwise stated.
   3. Internal lighting for ease of use
   4. Pivot arms for fiber slack management
   5. Standard of quality is Legrand
   6. Acceptable Substitutions are Systimax and Corning
   7. Fiber Enclosures

Part Number	Description

OR-INFC01U-M4	1U combo splice/patch enclosure, holds 4 adapter panels,
OR-INFC02U-M4	2U combo splice/patch enclosure, holds 8 adapter panels,
OR-INFC04U-M4	4U combo splice/patch enclosure, holds 16 adapter panels,

B. Splice cassettes (used instead of standard fiber optic adaptor panels)

Part Number	Description
OR-M4LCD12-50ES2A1	Fusion Splice Cassette 50um Multimode 12 fiber LC
OR-M4LCD12-09S1A1	Fusion Splice Cassette Singlemode 12 fiber LC

Fan Out Kits (if needed to build up 250um fiber before termination)

Part Number	Description
OR-61500858	Breakout Kit 12 fiber

C. FIBER OPTIC ADAPTER PANELS (used w/ pigtail or splice on connector terminations)

Legrand Adapter panels will be of 6 duplex LC connectors (12 fibers) for both multimode and single mode connections.

Part Number	Description
OR-HDFP-LCD12LC	6-LC Duplex multimode, aqua adapters, ceramic sleeve 12 fiber
OR-HDFP-LCD12AC	6-LC Duplex Single mode, blue adapters, ceramic sleeve 12 Fiber
OR-HDFP-BLANK	Blank Filler modules

D. FIBER OPTIC PIGTAILS / CONNECTORS

1. For fiber **splicing**, utilize Legrand 12 strand LC fiber pigtails or fusion splice on connectors. Legrand part numbers:

2. When **mechanical** terminations are acceptable for MAC work, Utilize Legrand LC single mode (OR-205KNT9SA-09) and multimode (OR-205KNT9GA-50T) Infinium Connectors for standard terminations.

Part Number	Description
OR-P1TC4ZRSZZZ001M	12 strand Single mode LC fusion splice pigtail
OR-P1TF4ZRGZZZ001M	12 strand Multimode LC fusion splice pigtail
OR-205KNF9SA-09	Single mode fusion splice on connector,
OR-205KNF9FA-50T	Multi Mode fusion splice on connector

OR-205KNT9SA-09	LC Single mode Infinium mechanical connectors
OR-205KNT9GA-50T	LC Multimode Infinium mechanical connectors

3. Acceptable Substitutions are Systimax and Corning

2.10 PATCH CORDS & FIBER JUMPERS

A. The contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. The UTP patch cables shall meet the requirements of ANSI/TIA 568-D for patch cord testing.

~~B. Copper (UTP) patch cords shall:~~

2.11 PATHWAYS & PENETRATIONS

A. Conduit

1. Minimum conduit size for horizontal branch data runs shall be 1 ¼".
2. All conduit work shall meet the requirements of the National Electrical Code.
3. All voice, data and video wiring inside rooms shall be protected by metallic conduit or other means such as Legrand/Wiremold or troughs in the floor. Aluminum is not acceptable in caustic environments. EMT conduit shall be used for all interior wiring. All conduits are to be concealed.
4. No more than an equivalent of two 90-degree bends are allowed in a run between junction boxes or pull boxes.
5. Entrance to junction boxes or distribution panels shall be adjacent to the corners.
6. In major renovation and new construction projects where the MDF/IDF are not in alignment, the contract shall include provisions for installation of four riser conduits (4 inches minimum diameter) from the MDF to each IDF. A pull string and appropriate junction pull box shall also be provided in each conduit run to facilitate future installation of cable(s). Maxcell fabric innerduct should be used to create multiple pathways in each 4" conduit.
7. All conduits in slab shall be a minimum of 11/4 inch. All exceptions shall be determined during the design stage of the project and shall be subject to the approval of the engineer.
8. All sleeves must protrude 4 inches AFF and below and be capped at both ends. Coordinate with customer for the number of conduits entering the facility. All sleeves must be bonded to the telecommunications bonding system.
9. No horizontal conduit run shall be more than 100 feet between pull boxes.

10. Pull boxes must be installed every 180 degrees or 100 feet of the conduit run. All conduit stubs must be bonded to the telecommunications grounding system.

B. Conduit/Raceway Capacity

1. Conduit shall be sized using industry standard guidelines for telecommunications distribution methods. Guidelines can be found in the Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual and/or cabling manufacturers' guidelines. Utilize Maxcell fabric innerduct to maximize conduit fills

Part Number / Series	Description
MXC4003 series	Standard 4" 3 Cell fabric innerduct
MXP4003 series	Plenum 4" 3 Cell fabric innerduct
MXR4003 series	Riser 4" 3 Cell fabric innerduct
MXD4003 series	Detectable 4" 3 Cell fabric innerduct
MXC3456 series	Standard 3" 3 Cell fabric innerduct
MXP3456 series	Plenum 3" 3 Cell fabric innerduct
MXR3456 series	Riser 3" 3 Cell fabric innerduct
MXD3456 series	Detectable 3" 3 Cell fabric innerduct

C. Cable Trays

1. The standard of quality for basket tray is **Cablofil.**

2. All cable trays shall be designed to accommodate all types of cabling. Note that installation shall be in non-return air plenum space only. All telecommunications pathways (Caddy J-hooks, basket tray or Legrand/Wiremold raceways) shall be used for communications medium (voice, data and fiber optic cabling) only.

3. The minimum dimensions for a cable tray shall be 12 inches wide and 4 inches deep. The tray must consist of continuous, rigid, welded steel or stainless steel wire mesh cable management system. The cable tray systems are defined to include, but are not limited to, straight sections, supports and accessories. Wire mesh cable tray will have continuous Safe-T-Edge T-welded top side wire to protect cable insulation and installers. Basket tray shall be spliced using EDRNs on the sides as well as an SWK washer/nut in the bottom of the tray.

4. All sections of the cable tray must be bonded together with approved bonding methods and devices. For installation of other types of "approved" low voltage cables in the cable tray, a separate tray or at minimum a divider in the basket tray to prevent interference from unshielded cables is required.

5. Supports for cable trays larger than 12 inches in width are to be installed according to the manufacturer specifications. A single support is not acceptable. All supports are to be fastened to the building structure above. If

the cable tray will be of a wall mount type, it must be installed properly to provide proper permanent support at trays maximum capacity.

6. Radius Dropouts shall be used whenever multiple cables are exiting the tray.

7. **STI's EZ Path's (44, 33 or 22 series) shall be used in conjunction with the tray whenever cabling is going through a fire rated wall.**

8. Cable trays must maintain a minimum of 6-inch clearance from obstructions above the tray and a minimum of 8 feet AFF. Trays are to provide access via the most direct path to all communications outlets on the floor.

9. Install sweeping factory 90's for all turns. Use end-of tray terminations where wire drops down to walls to prevent abrasions and cuts from metal tray edges. Use a trapeze supported cable tray mounting method suspended by manufacturer recommended size all-thread. Fasten all-thread to ceiling anchors, allowing no bends in all-thread. Support the cable tray in this manner at every section-to-section junction and at 5 feet to 6 feet intervals (mid span) between joints. Whenever possible, the tray should be no closer than 6 inches from the structural ceiling, ducts or pipes, considering all other possible obstructions. A minimum of 5 inches distance from lighting, especially fluorescent lighting, is desired.

10. Coordinate layout and installation of cable tray with other trades. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect. Basket tray installation in the TRs shall be installed as depicted on the drawings by the Telecommunications Contractor. The basket tray that is to be installed for the horizontal and backbone distribution will be provided and installed by the electrical contractor.

11. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

12. Refer to the drawings for the size and location of the tray to be installed.

13. Ground cable trays at end of continuous run. Ground continuous cable tray runs every 60 feet. Cable trays that are not UL Classified will be grounded per NEC requirements and manufacturer recommendations.

14. Ground cable trays against fault current, noise, lightning, and electromagnetic interference by mounting grounding wire to each 10' cable tray section with grounding clamp.

D. Open Top Cable Supports (J-hooks)

1. Standard of quality is Erico/**Caddy HP** series of j-hook
2. All open top cable supports (J-hooks) must be suspended from or attached to the structural ceiling or walls with hardware or other installation aids from

Caddy specifically designed to support their weight. When used, Caddy J hooks shall be located on 48-to-60-inch centers to adequately support and distribute the cables weight. These types of supports may typically hold up to fifty 0.25-inch diameter cables.

3. No other cables shall be run in the same j-hooks along with the voice and data cables. A separate painted (white, red, blue, green) Caddy j-hook system must be provided to facilitate the installation of other low voltage cabling.
4. For larger quantities of cables that convene at the Telecommunications Closet, provide Cablofil cable trays or other special ERICO/CADDY supports that are specifically designed to support the required cable weight and volume.
5. No plastic j-hooks will be allowed.
6. Substituted material must demonstrate product equivalency.

E. Floor Mounted Assemblies (Floor Boxes and Poke Throughs)

1. All Floor Mounted Assemblies including floor boxes, poke through, floor outlets, floor mounted whips, tombstones, etc. shall be sized using industry standard guidelines for telecommunications distribution methods; specifically relating to cable fill ratios and limitations. Guidelines can be found in the Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual and/or through individual cabling manufacturers' installation guidelines.

2. The standard of quality for all Poke-throughs and floor boxes is the Evolution series from Legrand/Wiremold. Refer to the wall/floor fittings schedule on the drawings/plans for specific types and configurations.

3. Floor boxes Shall:

   a. be used in concrete, raised floor and wood floor applications and are fully adjustable both pre and post concrete pour.
   b. have removable dividers and a tunnel feature that allows all compartments to be connected.
   c. have removable modules through the top or back of the floor box.
   d. The floor box hinge must be able to open to a full 180º and lie flat on the floor surface providing easy access to interior modules. Cable egress doors lock in position when open and will automatically close around wires to protect cabling and avoid tripping hazards.
   e. accept single, double or triple wall plates as well as accommodate power, communications and A/V devices.
   f. be designed to maintain up to a 2-hour fire rating.

4. Poke throughs Shall
   a. provide the interface between power, communication and audio/ visual (A/V) cabling in an above grade concrete floor and the workstation or activation location where power communication and/or A/V device outlets are required.
   b. provide recessed device outlets that will not obstruct the floor area. The poke-thru device shall be compatible with the complete line of workstation connectivity outlets and modular inserts.

c. permit all wiring to be completed at floor level.

1) The 6AT, and 6ATCFF units shall mount in a 6" [152mm] cored hole, actual 6 1/16" [154mm] core hole.
2) The 8AT units shall mount in an 8" [203mm] cored hole, actual 8 1/16" [205mm] core hole. Use is defined by the UL Fire Resistance Directory as a minimum spacing of “2 ft. [610mm] on center and not more than one device per each 65 sq. ft. [6m2] of floor area in each span.”

F. Wall Boxes (A/V, Power, Data behind flat screens)

1. The standard of quality for all wall boxes is the Evolution series from Legrand/Wiremold. Refer to the wall/floor fittings schedule on the drawings/plans for specific types and configurations.
2. Wall Boxes Shall:
   a. be used for TVs, Monitors, & Digital Signage for use in new construction and renovation construction projects.
   b. be compatible with complete line of workstation connectivity outlets and modular inserts, and most audio/video manufacturers’ products.
   c. provide the interface between power, communication and audio/video (A/V) cabling new construction and renovation location where power and communication and/or A/V device outlets are required.
   d. provide recessed device outlets that will not obstruct the wall area.
   e. permit all wiring to be completed at box level

G. Conference/Collaboration/Training Room Solutions (Table Boxes; Cable Retractors, Under-table cable management)

1. Standard of quality is Wiremold/Legrand Integreat series

2. **Table Boxes / Table penetrations**:
   a. Cover: Brushed, anodized aluminum cover in a black or aluminum finish with beveled edges and “soft-touch” handle.
      1) Cover contains a “pocket” door which fully recesses into the box when open, giving access to connections without obstructing work surface. A finishing plate hides hardware on activation surface and permits labeling of the AVIP plates.
      2) Cover flange allows for 1/4-inch [6.4mm] of forgiveness in the cut-out opening.
   b. Activation Surface: Adjustable downward in 1/2-inch [12.7mm] increments, from one (1) inch to four (4) inches [25mm to 102mm] to allow cover to close even when large style connectors are used.
   c. Provide table boxes with a 12-foot SJT cord for easy connection to electrical infrastructure.
   d. Supply tables boxes with a cable grommet kit that can accommodate up to eight (8) pull out connections. Boxes shall also be capable of accepting up to five (5) Wiremold AVIP connectors.
   e. Provide table boxes with two (2) 15-amp receptacles in top compartment and one (1) 15 amp receptacle on underside of box.

3. **Cable Retractors**: InteGreat™ Series cable retractors; mounts directly to InteGreat™ Series A/V Table Box or underside of conference room table using a horizontal mounting bracket.
   a. Cable Retractors with Category 6 Cable: Catalog No. TBCRCAT6; loaded with 12 feet [3.66m] of Cat6 cable that extends out five (5) feet [1.52m] from retractor. Supply retractor with a female input from building infrastructure and a male connector on the output side.
   b. Cable Retractors with VGA Cable: Catalog No. TBCRVGA; loaded with 12 feet [3.66m] of VGA cable that extends out five (5) feet [1.52m] from retractor. Supply retractor with a female input from building infrastructure and a male connector on the output side.
   c. Cable Retractors with HDMI Cable: Catalog No. TBCRHDMI; loaded with 12 feet [3.66m] of HDMI cable that extends out five (5) feet [1.52m] from retractor. Supply retractor with a female input from building infrastructure and a male connector on the output side. Provide input side with mounting tab that allows installer to cable tie HDMI to retractor to minimize chances of loose connections.
   d. Cable Retractors with 3.5MM Audio Cable: Catalog No. TBCR3.5MM; loaded with 12 feet [3.66m] of audio cable that extends out five (5) feet [1.52m] from retractor. Supply retractor with a female input from building infrastructure and a male connector on the output side.
   e. Cable Retractor Horizontal Mounting Brackets: Catalog No. TBCRHMK; permits retractor to mount horizontally under conference room table, enabling cable access through a table grommet. Multiple retractors can be mounted to each other by attaching the mounting brackets to each other.
4. **Under Table Cable Management Kit**: InteGreat™ Series under table cable management kit provides clean cable management for power, communication and A/V cables on horizontal underside of table.
   a. Under Table Cable Management Kit: Catalog No. UTCM5; includes five (5) feet [1.524mm] length of divided base, five (5) feet [1.524mm] length of mounting hinge rail and four (4) latching clips; black, nonmetallic construction.
   b. Transition Channels: InteGreat™ Series transition channels continue cable management and protection from underside of the table to the floor, where cables can gain access to building infrastructure. Channel fits directly into under table cable management kit on underside of table and mates with poke-thru device or over floor raceway for smooth transition to building infrastructure.
   c. Transition Channels: Catalog No. MRTC; consists of aluminum center spline with steel mounting plate and four (4) screws, black aluminum side channels, black nonmetallic bottom boot and two (2) black nonmetallic transition covers.

Part Number / Series	Description
EFB Series	Evolution Floor Box
6AT Series	Evolution Poke Throughs 6”
8AT Series	Evolution Poke Throughs 8”
EFSB2 Series	Evolution 2 Gang Wall Box
EFSB4 Series	Evolution 4 Gang Wall Box

TB Series	Integreat A/V Table Box
TBCRCAT6	InteGreat Cable Retractor Cat 6
TBCRVGA	InteGreat Cable Retractor VGA
TBCRHDMI	InteGreat Cable Retractor HDMI
UTCM5	InteGreat Under Table Cable Mgmt.
MRTC	InteGreat Transition Channel

5. Substituted materials for floor boxes, poke throughs, wall boxes and conference room applications must be able to demonstrate product equivalency.

2.12 AUDIO/VISUAL INFRASTRUCTURE

For applications involving patient rooms, classrooms, conference rooms, collaborative workspaces, etc., that require HDMI, USB, Display Port, VGA, and other digital and/or analog A/V connections, the cabling infrastructure shall utilize Quiktron as the standard of quality. Substituted materials for all A/V applications must be able to demonstrate product equivalency.

A. HDMI-to-HDMI, HDMI-to-DVI, DVI-to-HDMI and DVI-to-DVI

1. Direct (native signal) connections (point-to-point) shall be HDMI High Speed Rated and designed and tested to handle video resolutions of 1920 x 1080p or greater, including advanced display technologies such as 4K, UltraHD, 3D, and Deep Color
2. Direct (native signal) connections (point-to-point) shall not exceed 20 meters in total combined length and may be CMP, CMR, CM, CL3 or CL2 rated as appropriate to the installation and applicable code
1. Connections less than 20 meters in total combined length shall be a certified copper cable or connectivity solution, except when:
   a. Direct (native signal) connections (point-to-point) that require a form factor different than that typically available in a quality copper assembly may leverage the selection of “media conversion” and other solutions offered for such situations, and will include as acceptable alternatives RapidRun™, RapidRun Optical™ HDMI-over-Coax, HDBaseT, HDMI-over-UTP.
2. Connections greater than 20 meters in total combined length shall be certified connectivity solutions, as best serves the form factor needed, from the selection defined below:
   a. RapidRun Optical™
   b. HDMI-over-UTP, HDMI w/ serial RS232-over-UTP, HDMI w/ VGA-over-UTP, HDMI w/ VGA and Stereo Audio-over-UTP, HDMI w/ VGA, Audio, and Composite Video-over-UTP or HDMI-over-Coax
3. In installations where it is determined that insufficient bus power (Vbus) exists for reliable performance, the Quiktron HDMI Power Inserter may be used

B. Universal Serial Bus (USB)

1. USB connections (point-to-point) less than 5 meters total length shall be Quiktron USB 2.0 rated for all applications
   a. Systems specifically requiring USB 3.0 or faster speed transfer ability (SuperSpeed or SuperSpeed Plus) may include Quiktron USB 3.0 cables, which may not exceed 3 meters total combined length
2. USB connections (point-to-point) more than 5 meters in total length shall be Quiktron connectivity solutions, as best serves the form factor needed for installation, from the selection defined below:
   a. USB connections greater than 5 meters but less than 12 meters in length shall be Quiktron USB Active Extender Cable solutions, or
   b. USB connections greater than 5 meters but less than 100 meters in length shall be Quiktron USB 1.1 over Cat 5 SuperBooster or Quiktron USB 2.0 over Cat 5 SuperBooster solutions as required by the system design
3. USB external hubs shall be Quiktron USB 3.0 SuperSpeed rated with dedicated power supply (powered hubs)
   a. No more than four (4) tiers of USB connectivity shall be allowed without inclusion of a powered hub to restore full USB bus (V_{bus}) power for proper operation of downstream devices and links

C. DisplayPort

1. DisplayPort cables shall be Quiktron DisplayPort rated 1.1 performance or greater, and
2. DisplayPort point-to-point direct connections shall not be more than 10 meters in total combined length
3. DisplayPort point-to-point direct connections greater than 10 meters in total combined length shall be transported via DisplayPort-to-HDMI conversion (dongle) and shall then use an HDMI connection solution approved for connections of HDMI signals beyond 20 meters as detailed above (see HDMI), or
4. DisplayPort point-to-point direct connections greater than 10 meters in length shall be transported via RapidRun Optical

D. D-sub-15, mini sub D15, mini D15, DB-15, HDB-15, HD-15 or HD15, hereafter collectively called VGA

1. VGA direct (native signal) connections (point-to-point) shall be designed and tested to support video resolutions of up to QXGA (2048x1536) and pass Extended Display Identification Data (EDID) signals
2. VGA direct (native signal) connections (point-to-point) shall not exceed 50 meters in total combined length without appropriate signal conditioning and may be CMP, CMR, CM, CL3 or CL2 rated as appropriate to the installation and applicable code
3. VGA direct (native signal) connections (point-to-point) shall be certified connectivity solutions, as best serves the form factor needed, from the selection defined below:

a. RapidRun™
b. RapidRun Optical ™
c. Select or Select w/audio
d. Premium Shielded or Premium Shielded w/audio

2.13 POWER – UPS AND PDU OPTIONS

A. UPS (Uninterrupted Power Supply)

1. Standard of quality for Communications Rack Online UPS is Tripp Lite. Substituted material must be able to demonstrate product equality

2. Provide true online battery back-up, power conditioning UPS, rack mounted in each TR to serve network electronics as indicated on the drawings. UPS shall have the following features:
   a. 5000/3000/2200/1500 VA capacity as indicated
   b. Output operating range—280V (5000VA)/120V (<3000VA) nominal
   c. Communications—Unit shall provide an Ethernet based SNMP management interface, through the LAN to provide remote diagnostics and alarm conditions.
   d. Expandability—Unit shall provide for the connection if external battery packs in modules to extend the total unit run-time.
   e. Complete battery independence- Battery independent restart ensures automatic UPS power-up without user interaction after lengthy power outages, even when batteries are completely drained\discharged.
   f. Cord Length - 10'.
   g. Transfer Time- zero transfer time to battery.
   h. Battery Type- maintenance free sealed lead acid with electrolyte: leakproof.
   i. LED Status- On battery/Replace Battery/and overload indicators.
   j. Audible Alarms.
   k. Filtering -full time multi- pole noise filtering
   l. All UPS units shall be rack mountable with proper mounting hardware and support.
   m. UPS External battery Packs for 2200 or 3000 VA Tripp Lite for systems that specify extended run time such as the phone system.

3. UPS Sizes

   a. 1500 VA UPS (Tripp Lite part number SU1500RTXLCD2U) – Used in podiums, credenzas, conference rooms or classrooms
      1) Output Power Capacity- 1350W/ 1500VA.
      2) Nominal Output Voltage- 120V.
      3) Output Connections - (6) NEMA 5-15R
      4) Nominal Input Voltage- 120V.
      5) Input connections- NEMA 5-15P.

   b. 2200 VA UPS (Tripp Lite part number SU2200RTXLCD2U). Used in podiums, credenzas, conference rooms, classrooms and IDFs
      1) Output Power Capacity - 1800 wattts/2200VA.
      2) Nominal Output Voltage- 120V.
      3) Output Connections- (6) NEMA 5-15\20R and (1) NEMA L5-20R.
      4) Nominal Input Voltage- 120V.

5) Input connections - NEMA 5-20P.
6) Rack Mounted - 2U rack space.
7) Backup time- 12 minutes at half load (925 watts) 4 minutes at full load (1800 watts.)
8) Surge energy Rating – 570 joules.

c. 3000 VA UPS (Tripp Lite part number SU3000RTXLCD3U) Used in IDFs and MDFs
   1) Output Power Capacity- 2700 wattts/3000VA.
   2) Nominal Output Voltage- 120V.
   3) Output Connections- (4) NEMA 5-15R and (4) NEMA 5-15\20R and (1) NEMA L5-30.
   4) Nominal Input Voltage- 120V.
   5) Input connections- NEMA L30P.
   6) Rack Mounted - 2U rack space.
   7) Backup time- 11 minutes at half load (1350 watts) 4 minutes at full load (2700 watts.)
   8) LED Status- On battery/Replace Battery/and overload indicators.
   9) Surge energy Rating - 570 joules.

d. 5000 VA UPS (Tripp Lite part number SU5000RT4U) – Used in MDFs
   1) Output Power Capacity--3800 Watts/5000 VA
   2) Max Configurable Power--3800 Watts/ 5000 VA
   3) Nominal Output Voltage--120V, 208V
   4) Power factor equals 75% or greater
   5) Output Voltage Distortion--Less than 2%
   6) Output Frequency--(sync to mains) 50/60 Hz +/- 3 Hz user adjustable +/- 0.1
   7) Other Output Voltages--240
   8) Crest Factor--3: 1
   9) Topology--Double Conversion Online
   10) Waveform Type--Sine wave
   11) Output Connections--(8) NEMA 5-15\20R, (2) NEMA L6-30R, (2) NEMA L6-20R
   12) Bypass--Internal Bypass (Automatic and Manual)
   13) Nominal Input Voltage--208V
   14) Input Frequency--50/60 Hz +/- 5 Hz (auto sensing)
   15) Input Connections--NEMA L14-30P
   16) Input voltage range for main operation--100 - 140VAC (L1-N: L2-N)
   17) Input voltage adjustable range for mains operation--85 - 136V
   18) Other Input Voltages--240
   19) Interface Port(s)--RJ-45 10/100 Base-T
   20) Control panel LED status display with load and battery bar-graphs and On Line: On Battery: Replace Battery: Overload and Bypass Indicators
   21) Alarm when on battery: distinctive low battery alarm: overload continuous tone alarm
   22) Emergency Power Off (EPO)
   23) Surge energy rating 365 Joules
   24) Filtering Full time multi-pole noise filtering: 0.3% IEEE surge let-through: zero clamping response time: meets UL 1449

B. PDU Standard of quality is Tripp Lite part number PDUMV20NET SWITCHED/IP FEATURE SET REQUIRED. Substituted material must be able to demonstrate product equivalency.

1. Raceway and all components shall be UL listed. The base and cover shall be ivory in color and shall be attached to the cable ladder of the rack system or wall field as per the drawings.
2. Electrical outlet strip shall have (13) NEMA 5-15\20 outlets.
3. Provide all attachment hardware required to securely attach the outlet strip to the back of the vertical cable ladder or wallfield. Refer to the detailed drawings for required locations.
4. All power strips shall be equipped with surge protection.
5. All power strips shall be come with adjustable mounting brackets for 2 or 4 post installation.
6. Strips shall be 20A-120V with NEMA 5·20P on a 15 foot line cord.
7. Install and test all outlets prior to project completion.
8. Provide outlet strip with attached cord and 3-prong plug.
9. All power strips will plug into UPS units unless otherwise specified.

2.14 COPPER CABLE PROTECTION UNITS

A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TC ground point.

B. The standard of quality of protection units is Circa.

C. The two most frequently used lightning protectors are listed below.

D. Circa Protector -- “Circa”, part number 1900A1-100, and Circa 3B3S-300 “Red” modules -100 for 100 pair.

E. Use Circa, part number 1880ENA1/NSC-6 for single drops of 6-pair or less. Use Circa, part number 3B1E gas protector modules.

Part Number / Series	Description
1890BC1-25	25 Pair Protector
1890BC1-50	50 Pair Protector
1900A1-100K	100 Pair Protector
3B1E	Solid State Protector Module for 189B1
2626QC/QC	Protection Block (66 connection must add gas modules 3B1E (black) or 3B3E (red))
4B1E	Gas state Protector 5 Pin Black with Heat Coil
4B3S-75	Protector Module 5 Pin Red Solid state with Heat Coil

3B3S-300	Protector module 5 Pin Red Solid state w/o Heat coil
4B1S-300	Protector Module 5 Pin Black Solid state with Heat Coil
1880ENA1/NSC-6	6 Pair Protector

2.15 FIRESTOP

A. Standard of quality is EZ Path Fire rated cable pathway devices shall be used in fire-rated construction for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high-voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the prints. Such devices shall:

1. Meet the hourly fire-rating of fire rated wall and or floor penetrated.
2. Be tested for the surrounding construction and cable types involved.
3. Have UL Systems permitting cable loads from; “Zero to 100% Visual Fill.” This requirement eliminates the need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.
4. Not have inner fabric liner that tightens around and compresses cables tightly together encouraging potential cable damage or interference.
5. Be “Zero-Maintenance”, zero-maintenance is defined as; No action required by cabling technician to open and/or close pathway for cable moves, adds or changes, such as, but not limited to:
    a. Opening or closing of doors.
    b. Spinning rings to open or close fabric liner.
    c. Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
    d. Furnish letter from manufacturer certifying compliance with this definition of “Zero-Maintenance”.
6. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
7. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
8. Affix adhesive wall label immediately adjacent to devices to communicate with future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.
9. Cable pathway shall replace conduit sleeves in walls and floors, and;
10. When installed individually in floors, devices shall pass through core-drilled opening utilizing tested floor plates.
11. When installed individually in floors, devices shall pass through core-drilled opening utilizing tested floor plates.

12. When multiple units are ganged in floors, devices shall be anchored by means of a tested grid.
13. When installed individually in walls, devices shall pass through core drilled opening utilizing tested wall plates or integrated flanges.
14. When multiple units are ganged in walls, devices shall be anchored by means of a tested grid.
15. Cable tray shall terminate at each barrier (wall) and resume on the other side such that cables pass independently through devices. Cable tray shall be properly supported on each side of the barrier (wall). Cable tray shall NOT pass through the barrier (wall).
16. Substituted material must demonstrate product equivalency.

B. As an alternate to using a fire-rated or non-rated cable pathway device for single low voltage cables (up to 0.27 in. (7 mm) O.D) penetrating one or two-hour, gypsum board/stud wall assemblies or non-rated assemblies, either as a through-penetration or as a membrane-penetration, a fire-rated EZ Path individual cable grommet may be substituted. The product shall consist of a molded, two-piece, plenum-rated grommet having a foam fire and smoke sealing membrane that conforms to the outside diameter of the individual cable. The grommet product shall be capable of locking into place to secure the cable penetration within the wall assembly. The grommet shall be UL Classified and tested to the requirements of ASTM E814 (UL1479) and CAN/ULC S115.

17. Acceptable Products from STI:

Part Number / Series	Description
EZD22	2” EZ Path Firestop Device
EZD33FWS	3” EZ Path Firestop Device
EZDP133CWK	3” EZ Path Firestop Device Kit (for 4” conduit)
EZDP33FWS	3” EZ Path Firestop Device Kit (square mount)
EZP433W	3” Ganging Accessory (Qty 4) for 3” EZ Paths
EZD44S	6” EZ Path Firestop Device
EZDP44S	6” EZ Path Firestop Device Kit (square or round mount)
EZP544W	Ganging Accessory (Qty1-5) for 6” EZ Paths
EZGxxxxx	Grid for riser applications
RFG2	Individual Cable EZ firestop grommet (10 pack)

2.16 GROUNDING AND BONDING

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA-607 Telecommunications Bonding and Grounding Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a PBB (Primary Bonding Busbar) formerly known as the telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a SBB (Secondary Bonding Busbar formerly known as the telecommunications ground bus bar (TGB). The PBB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective SBB or PBB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

E. The standard of quality for all grounding and bonding products shall be Legrand.

F. Acceptable substitutions are Erico and Panduit

PART 3 - EXECUTION

3.1 SEPARATION FROM EMI SOURCES

A. Comply with BICSI TDMM and ANSI/TIA-598-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

B. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical equipment rating less than 2 KVA: a minimum of 5 inches.
   b. Electrical equipment rating between 2 and 5 KVA: a minimum of 12 inches.
   c. Electrical equipment rating more than 5 KVA: a minimum of 24 inches.

C. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical equipment rating less than 2 KVA: a minimum of 2-1/2 inches.
   b. Electrical equipment rating between 2 and 5 KVA: a minimum of 6 inches.
   c. Electrical equipment rating more than 5 KVA: a minimum of 12 inches.

D. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical equipment rating less than 2 KVA: no requirement.
   b. Electrical equipment rating between 2 and 5 KVA: a minimum of 3 inches.
   c. Electrical equipment rating more than 5 KVA: a minimum of 6 inches.

E. Separation between communications cables and electrical motors and transformers, 1/4 hp and larger: a minimum of 48 inches.

3.2 WORK AREA OUTLETS

A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where Caddy box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA 568.1-D document, manufacturer's recommendations and best industry practices.

C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

D. The bend radius of the twisted-pair horizontal cable shall not be less than 4 times the outside diameter of the cable.

E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

F. Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.3 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

C. Cable raceways shall not be filled greater than the ANSI/TIA 569-D maximum fill for the particular raceway type or 40%.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

E. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

G. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

H. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

I. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

J. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

K. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

L. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA 606-C. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.

M. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

N. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

3.4 HORIZONTAL CROSS CONNECT INSTALLATION

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA 568-D standard, manufacturer's recommendations and best industry practices.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. The cable jacket shall be maintained as close as possible to the termination point.

F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.5 OPTICAL FIBER TERMINATION HARDWARE

A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

E. A maximum of 12 strands of fiber shall be spliced in each tray.

F. All spare strands shall be installed into spare splice trays.

3.6 BACKBONE CABLE INSTALLATION

A. Backbone cables shall be installed separately from horizontal distribution cables

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits

D. Where backbone cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.

E. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

F. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.

G. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.

H. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.

I. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

3.7 COPPER TERMINATION HARDWARE

A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568-D standard, manufacturer's recommendations and best industry practice.

B. Pair untwist at the termination shall not exceed 12 mm (one-half inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.

F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.8 RACKS

A. Racks shall be securely attached to the concrete floor using a minimum 3/8" hardware or as required by local codes.

B. Racks shall be placed with a minimum of 36 inch clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.

C. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 2.11 of this document.

D. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

E. Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.

F. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

3.9 FIRESTOP SYSTEM

A. All firestop systems shall be installed in accordance with the manufacturer recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.10 PROTECTION DURING PAINTING

A. The Division 27 Contractor shall communicate with the General Contractor (or Construction Manager) and Division 09 Contractor to make all other trades aware of the cable manufacturers restrictions on field-applied coating of their products. In open structure ceilings and similar spray-painted spaces, all cable must be masked during the painting and/or fireproofing application to prevent damage by these coatings. Both new and existing cables shall be protected. Cables found to have been painted or coated will be considered damaged and will be replaced.

3.11 GROUNDING SYSTEM

A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the ANSI/TIA 607-C standard and shall be installed in accordance with best industry practice.

B. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.

3.12 IDENTIFICATION AND LABELING

A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA-606-C.

B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of ANSI/TIA-606-C. Furnish electronic record of all drawings, in software and format selected by Owner.

E. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

3. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

4. Both ends of all backbone cable shall be labeled. Labels will be self laminating and machine generated. The label shall contain the following information:
    a. The Origination (TR it is feeding from).
    b. The Destination (TR it is feeding).
    c. Number of pairs or fibers

5. Both ends of all horizontal cables shall be labeled. Labels shall be self-laminating and machine generated. The cable, workstation faceplate, panel ports and block positions shall be labeled with the room number, location in room, outlet type & # (data D1, D2, etc). In rooms with multiple outlets, label clockwise as you enter the room: 1, 2, 3 e.g. a data port at the first drop location to the left of Room 216 door would be (216-1 D1). When terminating workstation cables in the TR, organize and label the cables in numeric room number order at the patch panel.

6. CNS will approve all labeling schematics prior to installation. "As-Built" drawing with all outlets identified shall be provided.

F. Labels shall be self-laminating or computer-printed type with printing area and font color that contrasts with cable jacket color. Handwritten labels will not be acceptable.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

2. All labeling methodology, identification logic, and materials will be approved by customer prior to installation.

3. If existing labeling scheme is in place, all labeling will defer to currant scheme as to stay consistent with facility.

3.13 TESTING AND ACCEPTANCE

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA 568D; marginal passes (*PASS) are not acceptable. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and

connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

2. All cables shall be tested in accordance with this document, the ANSI/TIA standards, the Legrand Certification Program Information Manual and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Channel Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance.

2. Horizontal cabling shall be tested using a Level III test unit for category 6 performance compliance.

3. The basic tests required are:

    a. Wire Map
    b. Length
    c. Attenuation
    d. NEXT (Near end crosstalk)
    e. Return Loss
    f. ELFEXT Loss
    g. Propagation Delay
    h. Delay skew
    i. PSNEXT (Power sum near-end crosstalk loss)
    j. PSELFEXT (Power sum equal level far-end crosstalk loss)

4. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

5. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA 568-D Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

6. Category 6 Performance

   Shall meet the channel requirements outlined below for a 100-meter, 4-connector channel.

   Channel Margin Guarantees

Parameter	Margin vs. TIA-568-C.2
Insertion Loss	3%
NEXT	5 dB
PSNEXT	5 dB
Return Loss	3 dB
ACRF	5 dB
PSACRF	5 dB
ACR	5 dB
PSACR	5 dB

C. Fiber Testing

1. Testing procedures shall be in accordance with the following:
   a. ANSI/TIA 568-D
   b. ANSI/TIA 568.1-D
   c. ANSI/TIA 526-7-A, Method A.1
   d. ANSI/TIA 526-14-C, Method B
   e. TSB-140 Tier 1 fiber testing is required. Tier 2 Fiber Testing is recommended
   f. ANSI-TIA-1152-A determines the copper field test instrument values.
2. Preparation
   a. Properly clean all connectors, adapters, and jumpers prior to testing.
   b. Insure that the testing jumpers are of the same fiber core diameter and connector type as the fibers to be tested.
   c. The power meter shall be properly calibrated prior to testing. Contractor to provide written confirmation of the calibration, with the power meter serial number, to the Owner, if requested. If this documentation is not available upon request, the Contractor shall re-test all optical fiber cables after documented calibration of the power meter is accomplished.
3. Test Equipment
   a. Optical power meter and source (Certification tester Fluke or Agilent preferred). Suitable OTDR with launch cable for Tier 2 testing. OTDR Launch Cable length recommendation is 75 meters for MMF and 300 meters for SMF systems.
4. Testing
   a. All Multimode fibers shall be tested to the requirements of ANSI/ TIA-568-D, TIA-525-14A (Method A.1) and TSB-140. Optical fibers shall be tested at both 850 nm and 1300 nm wavelengths for end-to-end insertion loss .and Bi –Directional (MTR to TR-1, TR-1 to MTR)
   b. All Single-mode fibers shall be tested to the requirements of ANSI/ TIA-568-D, TIA-526-7 (or Method A.1) and TSB-140. Optical fibers shall be

tested at both 1310 nm and 1550 nm wavelengths for end-to-end insertion loss and Bi-Directional (MTR to TR-1, TR-1 to MTR)

c. Insure that the power meter and light source are set to the same wavelength prior to testing each fiber.
d. Connect an appropriate test jumper to the light source and power meter.
e. Power on both the power source and light meter, allowing them to stabilize.
f. Record the reference power reading in dB. If the jumper is removed from the light source for any reason, the reference power reading must be re-established.
g. Insert a second appropriate jumper, using an appropriate adapter, between the first jumper and the power meter. Record the power reading in dB.
h. Reference TSB-140 for additional recommendations and testing guidelines.
i. Provide written documentation of all test results to owner. Provide electronic copy of test results, in original tester format, to manufacturer when registering project for warranty on-line.

3.14 SYSTEM DOCUMENTATION

A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.

C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.15 TEST RESULTS

A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words “Project Test Documentation”, the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration

date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

B. The field test equipment shall meet the requirements of ANSI/TIA 568-C including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6 cabling systems.

C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form (format to be determined by the end user).

D. Test documentation shall also be provided to the manufacturer within three weeks after the completion of the project. Test results shall be uploaded when registering the project for warranty using the manufacturer's on-line system. Test results shall be in the tester's original format from an approved tester listed on manufacturer's website. All test results must show a PASS; marginal passes (*PASS) are not accepted.

E. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

3.16 AS-BUILT DRAWINGS

A. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD rel. 14) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.

B. The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD rel. 14) form.

PART 4 - WARRANTY AND SERVICES

4.1 WARRANTY

A. A warranty shall be provided for all internal infrastructure wiring as it pertains to voice and data networking for both copper and fiber systems. All installations

must be performed according to the manufacturer's System Warranty and Performance Application.

B. The warranty combines an extended product and applications assurance warranty for a minimum of 25 years.

C. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system.

D. The Application Assurance Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA-568.1-D. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, and 155 Mb/s ATM.

E. The contractor shall provide a warranty on the physical installation.

4.2 CONTINUING MAINTENANCE

A. The contractor shall furnish an hourly rate with the proposal submittal, which shall be valid for a period of two (2) years from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes to the system (MACs). MACs shall be performed by a certified Contractor and shall be added to the warranty when registered with the manufacturer.

4.3 FINAL ACCEPTANCE AND SYSTEM CERTIFICATION

A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a certificate, from the manufacturer, registering the installation.

END OF SECTION 27 06 10

SECTION 27 23 02 – AUDIOVISUAL SYSTEMS

PART 1 – GENERAL

1.1 This specification includes audiovisual systems for the Cafeteria, Gymnasium and Instrumental Music Rooms. Refer to the project specifications of other trades and contractors for items that may affect the work under this section.

1.2 Provide new materials and equipment that conform to the applicable requirements of Underwriters' Laboratories (UL), National Electrical Code (NEC), and all applicable local codes.

1.3 All material and equipment needed for proper operation of the system not specified or described herein shall be deemed part of the specifications.

1.4 GENERAL CONDITIONS:

A. Offers will only be considered from contractors who have at least five years of experience in the furnishing and installation of sound reinforcement systems that employ an equalization device comparable to that specified.

B. The contractor shall employ competent electronic technicians who are trained and knowledgeable in the area of sound systems.

C. At completion of the installation of the system and before final acceptance by the owner or owner's representative, the audiovisual contractor shall furnish two copies of the following:

i. Operating manuals, installation manuals, descriptive literature, and other information that is pertinent to the operation and performance of the system.

ii. Wiring diagrams for equipment and the system that indicate the wire and cable connections, including the connections between the amplifiers and associated loudspeakers.

iii. Manufacturer's warranties and the audiovisual contractor's warranties.

D. The contractor shall have available to the purchaser a service department capable of servicing all the equipment. Maintenance shall be provided on the premises during normal working hours at no cost to the purchaser for a period of 12 months from the date of system acceptance unless the failure or damage is caused by misuse, neglect, or accident. Service on the premises during other than normal working hours must also be available and may be charged at current labor rates.

i. The Contractor shall coordinate with the owner to work around events in the space and not allow events in the space to prohibit repairs being made or work completed.

1.5 QUALIFICATIONS:

A. It is the intent of this package to procure a supplier who can provide labor for the installation of new equipment, pulling cables, and for furnishing all cables and accessories necessary. The CONTRACTOR is responsible for leaving in place proper sized conduits with pull wires and boxes for the AV System Contractor use.

B. The AV System supplier shall be an "AV System Contractor" who regularly engages in the furnishing and installation of professional audiovisual systems.

C. The AV System contractor shall be an authorized and certified Dealer of the equipment listed within this specification. A copy of factory programming certification with respect to the AV Control System shall be included within the submittal package.

D. The AV System Supplier shall demonstrate to the satisfaction of the A/E and OWNER that they have:

i. Adequate staff and equipment to pursue the work properly and expeditiously.

ii. Adequate technical experience.

iii. Suitable financial status to meet the obligations of the work.

iv. Supplier to provide maintenance and warranty service for a period of 1 year after acceptance of installation to be included in the lump sum bid.

v. The Contractor shall have on staff an AVIXA certified CTS responsible for overseeing the project.

1.6 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.

B. Refer to related sections for additional requirements.

1.7 DRAWINGS:

A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the contractor in bidding the job. The contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.

B. The contractor shall verify all dimensions at the site and be responsible for their accuracy.

C. Prior to submitting the bid, the contractor shall call the attention of the Engineer to any materials or apparatus the contractor believes to be inadequate and to any necessary items of work.

1.8 SERVICE FACILITIES: Contractor shall make available to the Owner a service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts.

1.9 MANUALS: The manufacturer shall furnish a minimum of three complete sets of operating instructions and a service maintenance manual. This shall include internal schematics and wiring diagrams, detailed to allow a technician to install, operate, maintain, calibrate and repair the equipment.

1.10 EQUIPMENT: The equipment as specified is manufactured by QSC, SHURE, Symmetrix, Visionary Solutions, and Epson. Equivalent manufacturers are acceptable for proposed systems, at the final acceptance by the engineer and the owner.

1.11 SCOPE OF WORK:

A. Furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating SOUND SYSTEM. It is the responsibility of the system provider to provide the installation of the cabling.

1.12 SUBMITTALS

A. Specification sheets shall be submitted on all items including cable types.

B. Shop Drawings – Provide the following:

i. Provide detailed equipment assemblies and indicate dimensions, weights if needed, required clearances, method of field assembly, components, and location of each field connection, and a complete schedule of all equipment and materials with associated cuts sheets which are to be used.

ii. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed manufacturers and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components and levels throughout system and impedances.

iii. Rack layouts and elevation drawings showing positions of all AV components, interconnections, and mounting details.

iv. Projector calculations showing throw distance, lensing, mounting heights, etc.

v. Artwork drawings and lists indicating proposed nameplate nomenclature and arrangements for control panels and plug panels prior to fabrication reflecting equipment used.

vi. Each drawing shall have a descriptive title and all sub-parts of each drawing shall be labeled.

vii. All drawings shall have the name and locations of the project, and the Systems Contractor's name in the title block.

viii. Details and descriptions of any other aspect of the system, which must differ from the contract documents due to field conditions or equipment, furnished.

ix. Provide a system riser diagram showing all field devices and equipment rack layouts identifying the equipment to be installed.

C. Submit a certificate of completion of installation and service training from the system manufacturer.

D. Record Drawings: Prior to final acceptance, provide four (4) complete sets of drawings indicating all cable numbers, path the cable travel thru the school and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing".

1.13 IN-SERVICE TRAINING

A. System Training: Provide a minimum of two hours of system training for operating personnel.

1.14 WARRANTY:

A. Provide a manufacturer's one year warranty against defects in material and workmanship. This warranty will cover all electronic equipment, speakers, mixer, ETC. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost.

B. Contractor shall respond, excluding weekends and holidays, within 24 hours to any warranty service calls. If equipment cannot be repaired within 24 hours of service visit, the contractor shall provide "loaner" equipment to the facility at no charge.

C. Make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

1.15 FEATURES AND FUNCTIONS:

A. The Sound System shall provide at least the following features and functions:

i. Provide multiple channels of microphone connectivity, as shown on the contract drawings and associated line diagrams. Provide wireless microphone antennas in each space as required.

ii. Provide wall mounted AV racks in each space as noted on the contract drawings, including mounting hardware, cable shrouds, etc.

iii. Provide microphone input at wall jack locations, as shown.

iv. Provide wall mounted interface for Bluetooth devices, as shown.

v. Provide laser based ceiling mount projectors, and associated projector lift stations.

vi. Provide motorized projection screen and control stations.

vii. Provide wall mounted touch panels for control of audio levels and projector/screen operation.

viii. Provide HDMI projector inputs at locations shown.

ix. Provide all wall mounted racks and mounting provisions for each AV and Sound system.

PART 2 – PRODUCTS

2.1 ALTERNATE PRODUCTS:

A. The equipment described and furnished under these specifications shall be the standard product of one manufacturer, for each system component type, or as noted on the contract drawings. All equipment items that are identified by model number, type, or brand name are done so to establish the quality, function, and performance required of the specific equipment.

Alternates must be approved ten (10) days prior to the bid date. If submitting alternate speakers, provide EASE plots showing coverage at 200 Hz, 500 Hz, and 5 KHz.

B. Due to the nature and type of communications all products and solutions in this document have a standard of quality listed. Substitutions are listed, but products MUST demonstrate performance equivalency.

C. Alternate systems shall be required to be provided as a full equivalent system, with equivalency data and any deviations from the level of quality as dictated by the scheduled system components.

2.2 GYMNASIUM AV SYSTEM:

A. The Gymnasium will have AV and sound equipment as scheduled on the contract drawings, or an approved equivalent system. The sound equipment and the listed additional AV components shall be compatible and shall operate as a complete system. For substitutions, this contractor shall be responsible

for providing a complete equivalent system, including operational sequence and line diagram for review.

Refer to the contract drawings for final quantities and locations. This contractor shall be responsible for providing all interconnecting hardware, supports, mounting hardware, etc. as required for the location in which installed to provide a fully functional AV system.

B. The gymnasium as designed in this project has (2) layouts: Base-Bid and Alternate Bid, noting a reduction in overall floor size in the alternate layout. This contractor shall be required to provide an AV system as noted above and in the contract drawings in accordance with the final, selected Gymnasium layout, as determined during the bidding process. Refer to the front end specifications for additional information regarding alternates. Provide all devices and infrastructure for a fully functional system in accordance with the selected Gymnasium option.

C. Gymnasium AV devices located on the open gym floor or in the gym ceiling space shall be specified with high-impact housings, wire cages, etc. as dictated by specific manufacturer requirements.

2.3 CAFETERIA AV SYSTEM:

A. The cafeteria will have AV and sound equipment as scheduled on the contract drawings, or an approved equivalent system. The sound equipment and the listed additional AV components shall be compatible and shall operate as a complete system. For substitutions, this contractor shall be responsible for providing a complete equivalent system, including operational sequence and line diagram for review.

Refer to the contract drawings for final quantities and locations. This contractor shall be responsible for providing all interconnecting hardware, supports, mounting hardware, etc. as required for the location in which installed to provide a fully functional AV system.

2.4 INSTRUMENTAL MUSIC ROOM AV SYSTEM:

A. The Instrumental Music Room will have AV and sound equipment as scheduled on the contract drawings, or an approved equivalent system. The sound equipment and the listed additional AV components shall be compatible and shall operate as a complete system. For substitutions, this contractor shall be responsible for providing a complete equivalent system, including operational sequence and line diagram for review.

Refer to the contract drawings for final quantities and locations. This contractor shall be responsible for providing all interconnecting hardware, supports, mounting hardware, etc. as required for the location in which installed to provide a fully functional AV system.

PART 3 - EXECUTION

3.1 CONDUIT AND RACEWAY SYSTEMS:

A. The system shall be installed in conduit (E.M.T.). Install per Specification Section 260533 Raceways.

B. Provide a minimum of (2) spare 1-1/2” conduit from each AV rack to above ceiling, capped and labeled for future AV cabling.

3.2 LABELING:

A. Permanently label the front and rear of devices mounted in equipment racks to coordinate with the nomenclature used on the Drawings. Indicate the location and function that the equipment serves. Use only engraved plastic laminate labels on equipment.

B. Provide unique cable markers on both ends of every cable in the system. This should use a logical numbering scheme and should coordinate with in-house numbering schemes already in use. Markers shall be a clear heat-shrink or self-adhesive type and shall be within 152.4 mm (6 inches) of each termination.

C. Permanently label the plug end of the power cord of each device, indicating the device to which it attaches.

D. Permanently label ancillary devices such as switches, terminal strips, and receptacles in a logical manner clearly indicating their function in the system.

E. Clearly and logically label external devices such as audio mixers, wireless microphones, belt packs, and assistive listening receivers.

F. Label relevant inputs and outputs on switchers, matrices, and mixers.

G. Label nominal levels on devices with variable gain and control adjustments using adhesive dots.

H. Label the telephone numbers, ISDN numbers and IP addresses of pertinent devices.

I. Label equipment with externally visible labels that indicate the equipment’s serial number.

3.3 EQUIPMENT RACKS:

A. Perform rack fabrication before delivering the racks to the job site. Only wiring and terminations dependent on external devices shall be done at the job site.

B. Front and rear rack rails shall be inset 3”.

C. c. Test equipment power and functionality to the fullest extent possible prior to delivering the racks to the job site.

D. d. Equip the rack with sufficient AC power distribution to support equipment as well as two spare, non-switched, convenience outlets. One convenience outlet is to be readily accessible from the front and one readily accessible from the rear of the rack.

E. Provide service loops within the equipment rack for cables connected to external devices.

F. Locate equipment in racks to comply with ADA guidelines.

G. Install equipment racks level and plumb with the room and with adjacent racks.

H. Organize inner-rack cables in an orthogonal manner and organized into neat harnesses by cable type. The rear of equipment shall be fully visible without an array of cables in the way.

I. Horizontal cable management in rack shall be neatly tied in manageable bundles with cable lengths cut to minimize excessive cable slack, but allowing for service and testing.

J. Provide horizontal support bars if cable bundles sag.

K. Adhesive backed cable tie anchors shall not be used.

L. Velcro style cable wraps shall be used in vertical wire management. Plastic cable ties shall not be acceptable.

M. Arrange unlike signal types in separate harnesses maintaining adequate separation distances to avoid interference.

N. Package spare parts for each device in a clear plastic pouch and attach it to the rear of that device.

O. Allow the Owner’s Representative to inspect the racks for approval prior to delivery to the job site.

3.4 CONNECTING SYSTEM:

A. Check each speaker line for correct impedance and short circuits. The load shall not be greater than the amplifier output.

B. The system shall be equalized and balanced for optimum output and sound quality by the authorized factory representative.

3.5 CABLE INSTALLATION:

A. Neatly bundle excess AC power cabling with Velcro style cable wraps. Provide additional 10 spare cable wraps per AV rack for future use by the owner.

B. AC and low-voltage signal cabling shall not be run in the same raceway. Provide separate raceways per NEC requirements.

3.6 SYSTEM SETUP & PERFORMANCE VERIFICATION:

A. Preparation:

i. Interior finishes and furnishings shall be in place for these tests.

ii. HVAC system is to be balanced and in operation.

iii. Confirm complete and proper labeling of system components.

iv. Attach reduced-size Block Drawings to a rack in each location.

v. Remove boxes and debris from the project site.

vi. Deliver portable and spare equipment to the premises, tested and stored as directed.

vii. Tests and adjustments shall be performed in the sequence specified herein.

B. General Setup:

i. Verify that audiovisual related components are free from rough or jagged edges.

ii. Verify that rack ventilation is working properly.

iii. Verify that systems are free from oscillation and stray RF interference.

iv. Coordinate all wireless microphone channels with owner and their existing wireless systems.

v. Test and verify continuity and proper termination of every cable in the system.

vi. Following final acceptance of system set-up and performance, equipment with front panel controls, not normally adjusted by the operator shall have the controls disabled or be mounted behind blank panels or be furnished with security panels.

3.7 COMMISSIONING:

A. Work with the Owner's AV/ITS Staff and Technical Point of Contact to optimize functionality and setup of the system.

B. b. This phase of work will occur as soon as the system is functional and shall be coordinated with the AV Integrator.

C. c. The Contractor shall coordinate with the owner to work around events in the space and not allow events in the space to prohibit repairs being made or work completed.

3.8 DEMONSTRATING & TRAINING:

A. Shall occur in presence of Owner representatives to include the Technical Point of Contact deemed necessary by the Owner.

B. Shall be planned and coordinated at least 1 week in advance.

C. Provide 50 hours of system training and orientation for the Owner's personnel. Staff that is intimately familiar with the system and capable of making changes on the fly to satisfy detailed requests from the Owner shall be present during training.

D. Training shall occur PRIOR to the Owner using the system for the first time to ensure functionality and capability of use by the Owner.

E. Training shall include, but not be limited to:

F. Physical review of installed system.

i. Review of systems documentation and test results.

ii. Instructions on standard care and maintenance methods to enable Owner's personnel to successfully maintain the system.

G. Provide initial training session agenda with record of attendees and any changes to the system that were an outcome of the training.

H. Training shall occur in a phased manner, plan for three (3) individual training to occur at different times, one per space.

I. Provide one (1) additional day of training to take place 30 days after first training.

J. Provide line item pricing with bid for additional eight (8) hours' worth of training to be used in the future.

3.9 SYSTEM CERTIFICATION:

A. The system supplier's representative shall be on hand for final hook-up and

test, and shall certify, in writing, that the system is fully operational and meets the requirements of this section. This letter shall be included in the final documents required for Architect/Owner acceptance.

END OF SECTION 27 23 02

SECTION 27 51 23 - INTEGRATED IP BASED SAFETY AND INTERCOMMUNCATION SYSTEM WITH CLASSROOM SOUND ENHANCEMENT

PART 1 – GENERAL

1.01 DESCRIPTION

A. Owner Preferred Alternate #5: Provide products manufactured and provided by Audio Enhancement.

B. The requirements of the contract documents, including the General and Supplementary General Conditions and Division 1 – General Requirements shall apply to the work of this section.

C. At the time of proposal, any exceptions taken of these specifications, all variances from these specifications and all substitutions of operating capabilities or equipment called for in these specifications shall be listed in writing and forwarded to the Architect / Engineer. Any such exception, variances or substitutions which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval with comment.

1.02 SCOPE OF WORK

A. The work covered by this section of the specifications shall include all material, labor, hardware, software, firmware and programming to install a completed operating system as described herein and shown in the drawings. The system shall utilize the school's shared data network, and not require the use of any proprietary switches, routers, or other network components. The physical network components shall be provided by the owner or the contractor, the scope of this document does not include the physical network including switches, routers, or network cabling. Beyond the shared data network hardware, the rest of the system shall be complete with all necessary materials, labor, hardware, software, firmware and programming specifically tailored for the installation. It shall be possible to permanently modify the software on site by using a system administrator software network interface.
B. The intent of this specification shall maximize communications between the classroom and administrative areas utilizing VoIP (Voice over Internet Protocol) Technology while enhancing school safety and reducing maintenance, operational, and installation cost. Intended system shall integrate seamlessly as a complete system for local sound reinforcement as well as supporting intercom, paging, and bells functionality.
C. Under this specification, the system shall provide a complete VoIP Communication System for all classrooms and flex spaces as indicated on the drawings. An analog solution using speakers and volume controls in the offices, corridors, exterior locations, restrooms, gymnasium, cafeteria, and ancillary support buildings shall also be part of this project.
D. System shall support strobes or Visual Messaging Displays to alert of notifications as an integrated component of the system.

E. The Communication System shall provide VoIP or network distribution of intercom, overhead paging, emergency paging, class change time tones, emergency tones and program material. The system shall also support visual messaging that will match the audible messages from the system including automated setup of the devices.
F. Any and all miscellaneous materials, labor, hardware, software, firmware and programming that is not listed in the specification section that is required to provide a complete and operating system shall be provided as part of the scope of work for this installation.
G. The work covered by this section of the specifications shall be coordinated with all trades that are affected by the installation of this system. All work shall be complete and as required and specified elsewhere under these project specifications.
H. All the actual required system components and cabling are not shown or specified as this caries between acceptable manufactures and suppliers. It shall be the responsibility of the contractor to obtain this information from the acceptable supplier and or manufacturer and include the cost of the same in his bid.

1.03 APPLICABLE CODES AND STANDARDS

A. All devices of the system shall be listed by UL (Underwriters Laboratory). All components of the system shall bear the UL label.
B. The system shall be installed in strict accordance with all the requirements of the National Electric Code.
C. The system shall be installation in strict accordance with the requirements of the Americans with Disabilities Act (ADA).
D. The system shall be installed in strict accordance with the requirements of all other applicable codes as well as all Federal, State, and local codes.

1.04 RELATED DOCUMENTS

A. Secure all required permits and approvals prior to installation.

1.05 RELATED WORK

A. The contractor shall coordinate work in this section with all related trades that the system effects of integrates with. Work and / or equipment provided in other sections and related to the system shall include but not be limited to the following:
   1. Cable support system
   2. Structured Cabling System installer
   3. Network Infrastructure Supplier – switches/routers

1.06 SUBMITTALS

A. Furnish to the Architect / Engineer complete equipment submittal technical specification sheets and shop drawing submittals in .pdf format for this system including but not limited to the following:
   1. A material list with the quantity of each piece of equipment, names of manufacturers, model numbers and the technical data information on all equipment the contractor proposes to install. This material list shall be broken out and listed by Specification Section, per piece of equipment. If a piece of

equipment is needed but not listed in this specification section, it shall be listed in the area of the submittal it pertains to. The technical information shall be a piece of the manufacturer's printed literature that is produced by the equipment manufacturer. Internet web page listings will not be accepted. Provide a description of any special installation procedures that will differ from what is specified or shown on drawings.

2. Compete system circuit diagrams of the entire system, point to point on scaled floor plans scaled to match that of the scale of the project documents. The shop drawings are required to clearly illustrate how all components are related to each other and how they interconnect to each other. A complete point to point wiring diagram of any and all panels and how they interconnect with all the components and or devices that are part of the system as well as any ancillary devices that are being provided by other trades. All cables run shall be shown of the shop drawing submittals. Cable tags shown on the shop drawing submittals shall correspond with cable tags that are located inside equipment enclosures as well as documented on the as-built drawing. The shop drawing submittals shall include scaled drawings of all racks, panels, consoles and special assemblies. The show drawing shall include all circuit numbers of all cables and terminal connections as well as how they are labeled. Each drawing shall have a descriptive title and all subparts of each drawing shall be completely described. All drawings shall have the name of the project, Architect / Engineer and contractor in the title block. The floor plans, rooms names and numbers for the submittal drawings shall match that of the project documents. The symbol used on the submittal drawings shall match that of the project documents. The only information to be shown on the submittal drawings for this Specification Section shall be information that pertains to the system that is being submitted on.
3. Provide a detailed custom description of the operation of the submitted system for this installation and a statement listing every technical and operation parameter wherein the submitted equipment varies from what was originally specified. If the submitter fails to list a particular variance and his submittal is accepted; but subsequently, deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once without cost to the Owner. A letter or certificate from the manufacturer stating that the system contractor is an authorized distributor and installer of the submitted equipment shall be supplied.
4. The contractor shall be responsible for providing to the Architect / Engineer any and all additional information required and as deemed necessary by the Architect / Engineer for submittal and shop drawing submittal review.

1.07 QUALITY ASSURANCE

A. This specification section shall be a one (1) manufacturer responsibility or as specified herein with no exceptions. Any variances to this specification item shall be submitted to the Architect / Engineer ten (10) working days prior to proposal for review by the Architect / Engineer. The equipment manufacturer for this specification section has been in business manufacturing the specified equipment for a minimum of ten (10) years.

B. The contractor shall be the factory authorized and factory certified distributor and installer of the equipment to be provided for this specification section. The installation

contractor's factory certification shall be submitted to the Architect / Engineer as part of the contractor's subcontractor and materials list at the time of the bid as well as with the ship drawing submittal.

C. The contract for the systems described herein shall be assigned to the general contractor for the building construction. The intercommunication system contractor shall coordinate all work and work sequencing with the general contractor.
D. Owner and Architect / Engineer Inspections: The Owners technology staff and Architect / Engineer shall provide advice as requested. The Owners' technology staff shall inspect the project as the work progresses. Prior to final acceptance of the work, the Contractor shall decide with the appropriate authorized Owner personal to inspect the construction areas, both to ensure satisfactory completion of the work and to ensure complete cleanup and restoration of areas affected by the work. Temporary protection, coverings, and structures shall be removed at or before the time of inspection.

1.08 CIRCUITING GUIDELINES

A. All wiring shall be Cat. 6/6a for connections to speakers, call switches, etc… for future migration to a complete IP (Internet Protocol) based intercom paging system. Cabling from the MDF or IDF to each classroom enclosure shall be provided by the electrical contractor. A patch cable, providing connectivity from the work outlet faceplate to the MS-500 shall be provided by electrical contractor to the AV contractor for connection to the network.
B. Each classroom / education space to have a dedicated network connection to the intercom paging system head-end to provide 2-way communications from the integrated paging system console as well as the district IP based phone system.
C. Each office / administrative space to have 1-way communications from the paging system and is capable to being addressed from the building telephone system handset.
D. Each corridor / common space / exterior space including library, cafeteria and gymnasium to have 1-way communications from the paging system and be capable of being addressed from the building telephone system handset.
E. All wiring shall be in accordance with the manufacturer's specifications and certified for performance.

1.09 SEQUENCE OF OPERATIONS

A. The ability to be distributed via a fiber 10/100/1000Mb switched, VLAN enabled network or 10/100/1000Mb switched stand-alone intercom network. It shall be possible to eliminate the need for copper feeder cables between the Main and Intermediate distribution frames using fiber optic cabling.
B. Shall have SIP (Session Initiation Protocol) Integration to connect all talk-paths to the VoIP phone system of choice. This shall support registering as an extension on the system or through he use of a SIP Trunk.
C. The system shall provide the ability to support a SIP tunnel from the building's VoIP phone system to provide two-way communication from all administrative telephones to any location equipped with a talkback speaker or audio system with room microphone.

D. System shall interface with any VoIP telephone system using SIP type integration thus allowing the school(s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system. Any system that limits system features based upon any selected telephone system and is not SIP based shall not be acceptable.
E. The system shall have the ability to call 911 from the classroom as a part of the intercom communication system giving opportunity of messages to identified individuals or groups.
F. System alerts must be able to be self configured and triggered from both classroom and headend. Alerts for example are medical, lockdown, evacuation, hold in place, disturbance, etc.
G. Automatically sound a tone or play a pre-page WAV file over any loudspeaker connected for two-way communication to alert the classroom teacher that this 2-way call has been established. This is intended to prevent unauthorized monitoring.
H. Distribution of emergency announcement(s) from any authorized telephone to all areas furnished with a loudspeaker. Emergency announcements shall have the highest system priority
I. Distribution of general announcements from any administrative telephone, staff telephone, or classroom telephone. The system shall be capable of providing all-call, group call, or multiple group call.
J. Classroom speakers or audio systems with room microphone shall be software assignable to unlimited paging groups.
K. Provide the ability to define and archive unlimited schedules with up to three hundred (300) events per schedule. Each scheduled event shall be capable of activating included tones or playing custom audio/voice phrases or controlling any I/O port on a system network interface for building control and scheduled along with a bell. Schedule administration, modification and creation functions shall be available through web access on remote computers and mobile devices.
L. The system shall automatically make audible messages display on scrolling LED displays as needed with no additional programming.
M. The system shall support a strobe light to be used in conjunction with audible messages for loud areas.
N. The system shall provide an administrative console for the front office, consisting of a touch screen interface no less than 22” diagonal interface.
O. The system shall support CAP and allow for API interoperability such as gunshot detection, weapon detection, vape detection, and other 3rd party hardware.
P. The User Interface shall be map based and support full touch operation. The manufacturer shall provide the ability to take a map in any format, including paper copy, PDF, Visio, etc. and create from that the map used for the primary user interface. Non map-based User Interfaces will not be considered.
Q. The WAV or MP3 files shall be activated via the administration software, telephone and / or telephone system and / or pushbuttons.
R. The system must allow 3rd party IP Cameras integrations into the system map to display during emergency events.
S. The system shall be capable of dynamic room/zone paging.
T. The WAV or MP3 files shall be programmable as to what level of priority they can be broadcast. They shall be programmable to override any class change tones, normal all call, music, and intercom in the event of an emergency.

U. The WAV or MP3 files shall also have the ability to be broadcast into any one or all of the zones with the system. Simultaneous playback of different audio to different zones must be possible.
V. The WAV or MP3 files shall have the ability to be broadcast via a schedule for any day of the week or time of the day. They shall also have the ability to be broadcast for any duration of time and repeat number of plays with the ability to select how long the duration is between each repeated broadcast.
W. The WAV or MP3 files shall also have the ability to be a part of the classroom change tones within the system. These files shall be able to replace any tone within the class change schedules as to offer the flexibility of customizable tones and or phrases in this class change mode.
X. It shall be possible without the cost of additional hardware/software to incorporate a LAN / WAN district wide paging system by means of the built in VoIP district Paging Adapter or district software. This adapter shall give the district the ability to page each school independently, as a group of schools, or all schools.
Y. The system shall be capable of automatically listening into a classroom in the even of a alert or lockdown.
Z. The system shall allow for the integration of changeable message signs to support bells and notifications. These signs shall be multi-color, multi segment LED scrolling displays and powered and controlled via a network PoE (Power over Ethernet) connection.
AA. The system shall also allow for the integration of third-party system through the use of contact closure, TCP (Transmission Control Protocol) communication, RS-232 communications and HTTP (HyperText Transfer Protocol) communications.
BB. The system shall support and allow for devices to be managed within the system itself including device discovery, automated programming and automated assignment to rooms and zones.
CC. System must support device programming templates per device per site and support making individual adjustments to those templates on a per device basis and that setting would supersede the template for that device only.
DD. System shall support monitoring and upgrading firmware of supported devices.
EE. System shall support management of IP based PoE visual message displays and automate the programming of devices through the interface including automatically applying visual messages for bells and notifications without the use of a secondary application or software.
FF. The system shall support door status monitoring with alerts and warning based on defined times. There must be the ability to bypass reporting based on bell schedules and special events.
GG. The system shall support an automated commissioning function that allows the system to be placed into a test mode and monitors and reports the commissioning status of the devices.
HH. System shall support a district server that will allow for management and monitoring of all schools in the district. Server must support physical and virtualized server deployments. The district central server will allow for centralized paging to entire district, groups of schools or individual schools. Server will support the ability to record and preview the page before it sends to the sever. Server will also support sending notifications to a school, group of schools or entire district. Server will support defining associated campuses for schools to automate events and notifications at those sites. Shall support centralized reporting of alerts and allow to directly interact

with alert. Server interface shall be map based and support nested maps allowing for closer detail on an area or grouping of schools. District server shall support monitoring servers and devices at campus and alert via UI on any degraded or offline devices. Server shall support direct access of campus servers through single pane of glass and will not require authenticating into individual sites.

1.10 WARRANTY

A. The manufacturer and installation contractor shall guarantee the system, equipment and all its components for a minimum of one (1) year from date of final acceptance of the system as documented by the Architect / Engineer. This guarantee shall cover the replacement of all parts and labor to replace the same made necessary by normal usage and wear.
B. Upon completion of the installation of the system, the contractor shall provide to the Architect / Engineer and Owner a signed written statement, on company letterhead, substantially in form as follows: “The undersigned, have engaged as the Intercom paging system contractor for the Fayette County STEM building project confirms that the system was installed in accordance with the wiring diagrams, instructions and directions provided by the manufacturer.”
C. Contractor shall repair, adjust, and / or replace, whichever the Owner and / or Architect / Engineer determines to be in its best interests, any defective equipment, materials, or workmanship, as well as such parts of the work damaged or destroyed by such defect, during warranty period, at the contractor’s sole cost and expense.
D. In the event that any of the equipment specified, supplied, and / or installed as part of the work should fail to produce capacities or meet design specification as published or warranted by the manufacturer of the equipment involved or as specified in this document, the contractor shall, in conjunction with the equipment manufacturer, remove and replace such equipment with equipment that will meet requirements without additional cost to the Owner.

1.11 TRAINING AND INSTRUCTION FOR OWNER MAINTENANCE

A. A training program including a minimum of four (4) hours on the use of the system shall be provided to the Owner to use at their discretion. A full and complete overview of the system shall be included in this training as well as any literature required by the Owner to allow complete and total use of the system by the Owner’s designated staff. System maintenance requirements for the equipment will also be documented and turned over the Owner. User and help videos shall also be made available to the customer via USB thumb drive or via an online fashion.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The following manufacturers are approved to submit proposals for this project:
   1. Basis of Design: Audio Enhancement – EPIC (Education Paging & Intercom Communications) System
   2. Alternate Manufacturers: Atlas IED, Bogen Communications & Intercom

3. Additional manufacturers meeting the above qualifications and system performance/intent shall be permitted to submit proposed systems for this project. Proposed systems shall be reviewed by the design team and the owner for acceptance. Proposed systems shall be submitted with qualification data, proposed system architecture, and reference information for review/acceptance.

   Final acceptance of alternates shall be at the discretion of the engineer of record and the owner.

2.02 EQUIPMENT

A. INTERCOM PAGING SYSTEM:

1. The system shall be a software-controlled system, whose primary interface is a web-based portal, accessible from any authorized computer. The system shall support being deployed on physical server hardware or through vitalization on the customer's hardware. For the physical server, the system shall utilize a 1U rack server, operating as an appliance, dedicated to the operation of the IPB (Intercom Paging and Bells) & SAFE (Signal Alert For Education) System™ only. The rack server shall have industry standard redundancy, including RAID1, Dual Power Supplies, and hot swappable hard drives. The entire system shall be Linux based. If virtualized the system shall support VMWare ESXI version 6.5 or later.
2. The system shall be based on standards compliant SIP and RTP communications across the network and shall allow direct Trunk Integration to the VoIP telephone system.
3. The system shall provide a simple calendar-based scheduling system for bells. It shall provide the ability to have an unlimited number of bell schedules.
4. The system shall provide a map-based User Interface. All major functions, including Intercom, Paging, Notifications and Alerts shall be done using the map as the foundation for those actions. Paging shall clearly show on the map where the page audio will be transmitted to.
5. Bell Schedules shall be easily assigned to days and changed simply with authenticated access to the system through any browser-based device. Bell schedules shall be able to be changed even if a current schedule is active in the system same day and apply immediately.
6. The system shall support utilizing a shared data network and support (VLAN [Virtual Local Area Network] enabled) or dedicated network as means of distribution for all voice overhead paging, emergency paging, emergency tones, intercom, and class change tones. System shall support routing of traffic across multiple subnets and network segments.
7. The system shall be capable of accessing remote classrooms (trailers, temporary classrooms etc.) via IP interface or room audio system with room microphone. This shall provide intercom, class change tones, emergency tones, and normal / emergency paging via a wired network to these remote locations.
8. Exterior speakers shall be capable of being on separate zones and programmed separately.
9. The system shall have the ability to synchronize to the same NTP server utilized for the Master Clock system.

10. The system shall have the ability to produce user defined tone signals for time tones or emergency tones.
11. The system shall have SIP Integration to connect all talk-paths to the VoIP phone system of choice.
12. The system shall provide the ability to support a SIP trunk from the building's VoIP phone system to provide two-way communication from all administrative telephones to any location equipped with a talkback speaker or audio system with room microphone.
13. The system shall interface with any VoIP telephone system using SIP type integration thus allowing the school (s) to upgrade or replace their telephone system without suffering a requirement to replace, or lose any feature of, their internal communications (intercom) system. Any system that limits system features based upon any selected telephone system and is not SIP based shall not be acceptable.
14. The system shall provide its own SIP environment, and in the case of a failure of the schools VoIP telephone system, be capable of operating completely independently for all functions, save access from the handsets connected to the schools VoIP system.
15. The system shall not be reliant on WAN or internet connectivity for operation.
16. The system shall provide web access, which will give ability to monitor operations and functions of the system.
17. The system monitors the status of all connected devices for health, SIP connectivity and connected devices including the XD receiver. If a device becomes in a degraded or offline state, the system will monitor a technical contact via email and or SMS as well as show status on the map of the console.
18. The system shall provide web-based off-site programming and diagnostics of the system. It shall also be capable of determining basic circuit faults.
19. The system shall have a Web based administration programming tool which allows the administrative personnel to easily manage Audio Sources, Class Change schedules, paging groups, time updates, holiday schedules and day/night mode operation from an internet browser. System shall support HTML5.
20. The system shall provide calendar-based scheduling up to four years in advance. The system shall be capable of displaying a fully year calendar and differentiating which bell program is scheduled to run on each day. The calendar shall be based on a standard school year and provide a selectable start month for example, it can be configured to run from August to July.
21. The system shall be capable of being fully integrated with the school's existing LDAP (Lightweight Directory Access Protocol) or Active Directory system. Systems that do not provide LDAP or Active Directory integration shall not be considered.
22. The system shall provide discreet control over roles for the system. Roles shall be definable down to the individual feature level and provide the district with the ability to restrict or grant access to any roll individual features or groups of features.
23. The system shall provide web browser access to the system specifically for a teacher. Teacher access shall be assigned through LDAP or Active Directory. The Teacher screen shall provide information specific to the room that the teacher is assigned to. That information shall consist of, but not limited to, the

next scheduled event for the room (Bell, Announcement, etc.), Audio/Visual Controls for their classroom technology, Teacher Name, Room Number, an Intercom Call button, and an Emergency call button.

24. The system shall have the ability to carry IP Communications to the edge of the classroom Audio/visual Systems. It shall be able to control connected A/V Devices, provided that those devices are controllable by RS-232
25. The system shall be based on a database structure, utilizing a robust commercially available database such as SQL (Structured Query Language).
26. The system shall provide 2-way handsfree communication in each classroom.
27. System Classroom and Common Zone network interfaces shall be capable of utilizing standard Cat 6/6a infrastructure for installation from the Telecommunications Closets only to the classroom and/or zone, thus allowing for only one type of wiring infrastructure within the school. Distribution of all voice signaling shall utilize a shared or dedicated network. Systems that require homerun, dedicated, 18 gauge shielded wiring shall not be acceptable.
28. The system shall provide a flexible and robust event engine. In addition to pre-programmed events and actions, the event engine shall be capable of accepting Java-based programming to accomplish advanced integrations and functions.
29. The system shall automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions shall be preprogrammed and require no user intervention. The system shall provide redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
30. The system shall provide the ability for the school to upload their own recorded files for both Bell Tones, and Notifications
31. The system shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone within the facility or outside the facility to any other location within the facility or district.
32. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in the system. This shall allow handsfree communication to any classroom or any individual loudspeaker unit. A pre-announce tone shall sound immediately before the intercom path is opened.
33. The system shall provide a complete personal alert function for each teacher. The alert functionality shall be an integrated part of the administrative head end software and shall not require any separate application or hardware to support this functionality.
34. The teacher personal alert functionality shall be integrated into the classroom microphones and the teacher web screen.
35. The system shall be capable of displaying on the map the location of the alert in the case of a microphone that is within range of its paired receiver, or from the teacher’s web access screen. The system shall also be capable of approximately locating the location of the alert in the case of a microphone that is not in range of its paired receiver. A system, either the microphone system, or the administrative system that is not capable of receiving an alert from a microphone that is not within range of its paired receiver shall not be considered.

36. Upon alert, the system shall have the ability to provide notification on the dedicated console at the front office, or on any other computer which is currently logged into the administrative interface and has the appropriate credentials. The system shall provide both an audible tone, and a change on the screen that clearly indicates that an emergency alert has been received.
37. Upon alert, the system shall also be capable of sending e-mail and SMS Text messages to the designated school personnel. These alerts shall include a web link to the administrative console.
38. If cameras are installed in the classrooms, the system shall be capable of showing a live video from the classroom that received an alert. This shall only be shown in the case of an alert where the microphone is within range of its paired receiver.
39. The system shall have the ability to acknowledge the receipt of the alert by changing the indicators on the classroom microphone receiver in the room where the alert was received from. In the case of an alert received from a microphone not in range of its paired receiver, no acknowledgement shall be sent.
40. The system shall have the capability of maintaining a record of all alerts that are received and provide appropriate school personnel with the capability to enter information about the alert, which shall be maintained in the systems database. That information shall also be made available to appropriate school personnel in the form of a report that shows all alerts that have occurred, their date, time, and the end alert information.
41. The system shall contain a rules-based integration engine that allows for input of TCP, HTTP, or Serial Data and allows for the parsing of data for actions or triggering other systems via TCP, HTTP or Serial.
42. The system shall support digital message displays that provide visual feedback in the form of scrolling messages via an LCD or LED display all controlled from the network.
43. The system shall allow for integration into the classroom audio system including teacher microphone as required by design. This includes integration to ensure that system notifications, pages and intercom calls take priority over classroom audio sources.
44. The system must include perpetual licensing and include all in version software upgrades at no additional cost.
45. The base functionality of the system including the map interface, intercom, paging, bells, classroom audio control, SAFE System and Event engine must be part of the base licensing of the product and not require additional licensing.
46. The system shall have the ability to control signage displays for display of clocks, messages, digital signage, countdown timers as well as allow for automated messages to be displayed automatically for notifications.
47. The system will allow for the building of clock signs, message signs as and notifications signs using the HTML EPIC interface allowing for using predefined templates and assets.
48. Clocks and emergency signs shall be a onetime perpetual license.
49. Server software shall require end user to create complex unique passwords for each system on first use. Systems that allow for generic or repeated passwords will not be acceptable.
50. System shall utilize a visual based event editor to define custom actions, inputs and outputs.

51. System shall support connection to District View Server for centralized management and licensing and services must be included as part of the system to support that connection, integration and programming.

B. Cafeteria Requirements:
   1. System shall operate as a standalone system. Speakers in the space shall operate as two zones and shall operate as a normal paging system under normal conditions. There shall also be an AV mode, where the system can utilize one or both speaker zones to play audio associated with the projector in the space. System shall come equipped with XD Receiver, dedicated EPIC amplifier, UPS and AV Connect Wall Plate as shown on drawings as well as any additional components required for a functional system. System shall be housed in a rack enclosure specified in sound system specification. System shall come with two teacher body pack microphones and two student handheld type microphones. See specifications below for full requirements for all of these devices.

C. Media Center Requirements:
   1. System shall operate as a standalone system. Speakers in the space shall operate as two zones and shall operate as a normal paging system under normal conditions. There shall also be an AV mode, where the system can utilize one or both speaker zones to play audio associated with the projector in the space. System shall come equipped with XD Receiver, dedicated EPIC amplifier, UPS and AV Connect Wall Plate as shown on drawings as well as any additional components required for a functional system. System shall be housed in a rack enclosure specified in sound system specification. System shall come with two teacher body pack microphones and two student handheld type microphones. See specifications below for full requirements for all of these devices.

D. Gymnasium Requirements:
   1. Audio Enhancement system in the gymnasium shall be capable of two functions, utilizing two separate amplifiers:
      a. One function shall be capable of serving as an input to the Gymnasium sound system as an input. System shall be capable of using the typical Audio Enhancement body pack microphones and student handheld microphones for this capability.
      b. Second function shall be operation of the standard PA system in this space.
   2. Gymnasium shall be provided with two three total teacher body pack microphones and three total student handheld type microphone devices.

E. INTERCOM PAGING SYSTEM NETWORK INTERCOM INTERFACE:
   1. Shall allow users to install intercom paging systems spanning multiple building or facilities connected through a VLAN.
   2. Network Requirements:
      a. 100/1000 Ethernet switch port configured on a dedicated VLAN.
      b. Systems requiring a specific network or subnet size are not allowable.

F. INTERCOM PAGING SYSTEM POWER:
   1. All Network interfaces used in the classroom and for the common zones shall be powered via PoE from the district provided network switches.
      a. PoE switches and network cabling from MDF (Main Distribution Frame) and IDF (Intermediate Distribution Frame) to devices provided by others.
   2. All network switches shall include an uninterruptable power source to provide adequate runtime. In the event the school has a generator the UPS systems shall hold the switches long enough until generator power can be provided. Customer to provide all necessary UPS for network switches.

G. APC BACK-UPS, 6 OUTLETS, 425VA, 120V
   1. Output
      a. Output power capacity - 255 Watts / 425VA
      b. Max Configurable Power (Watts) 255 Watts / 425VA
      c. Nominal Output Voltage 120V
      d. Output Frequency (sync to mains) 50/60 Hz +/- 3 Hz Sync to mains
      e. Topology Standby
      f. Waveform type Square wave
      g. Output Connections (4) NEMA 5-15R (2) NEMA 5-15R
      h. Transfer Time 6 ms typical : 10 ms maximum
   2. Input
      a. Nominal Input Voltage 120V
      b. Input frequency 50/60 Hz +/- 3 Hz
      c. Auto-sensing Input
      d. Connections NEMA 5-15P
      e. Cord Length 4.99ft (1.5meters)
      f. Input voltage range for main operations 88 - 139V
      g. Number of Power Cords 1
      h. Maximum Input Current 5.0A
   3. Batteries & Runtime
      a. Battery type Lead-acid battery
      b. Typical recharge time 8hour(s)

H. APC SMART-UPS 1000VA, RACK MOUNT, LCD 120V WITH SMARTCONNECT PORT
   1. Output
      a. Output power capacity - 700 Watts / 1.0kVA
      b. Max Configurable Power (Watts) - 700 Watts / 1.0kVA
      c. Nominal Output Voltage - 120V
      d. Output Voltage - Distortion Less than 5 %
      e. Output Frequency - (sync to mains) 50/60 Hz +/- 3 Hz Sync to mains Other
      f. Output Voltages - 110, 125 Load Crest Factor 3 : 1
      g. Topology Line - interactive
      h. Waveform type - Sine wave
      i. Output Connections - (6) NEMA 5-15R
      j. Transfer Time- 6 ms typical : 10 ms maximum
   2. Input
      a. Nominal Input Voltage 120V
      b. Input frequency 50/60 Hz +/- 3 Hz

c. Auto-sensing Input
d. Connections NEMA 5-15P
e. Cord Length 8.01ft (2.4meters)
f. Input voltage range for main operations 75 - 154 Adjustable, 82 - 144V
g. Number of Power Cords 1
h. Other Input Voltages 110, 125

3. Batteries & Runtime
   a. Battery type Lead-acid battery
   b. Typical recharge time 3hour(s)
   c. Replacement Battery APCRBC157
   d. Expected Battery Life (years) 4 - 6
   e. RBC Quantity 1
   f. Battery Charge Power (Watts) 112 Watts
   g. Runtime
      i. View Runtime Graph (Available in Technical Tab on site)
      ii. View Runtime Chart (Available in Technical Tab on site)
   h. Efficiency View Efficiency Graph (Available in Technical Tab on site)
4. Communications & Management
   a. Interface Port(s) RJ-45 Serial, SmartSlot, USB
   b. Control panel Multifunction LCD status and control console
   c. Audible Alarm when on battery : distinctive low battery alarm : configurable delays
   d. Available SmartSlot™ Interface Quantity 1
5. Surge Protection and Filtering
   a. Surge energy rating 680Joules
   b. Filtering Full time multi-pole noise filtering : 0.3% IEEE surge let-through : zero clamping response time : meets UL 1449
6. Physical
   a. Maximum Height 3.39inches (86MM, 8.6CM)
   b. Maximum Width 17.01inches (432MM, 43.2CM)
   c. Maximum Depth 18.78inches (477MM, 47.7CM)
   d. Rack Height 2U

I. EPIC COMMON ZONE AMPLIFIERS and Large Space Amplifier: Provide one each for Cafeteria and Media Center, as well as amplifiers required for common zone paging.
   1. LED Information
      a. AC Power
      b. Green – Powered On
      c. Orange – Standby Status
      d. Red – Booting
      e. Green – Ready
      f. GPIO (General Purpose I/O)
      g. Yellow – Input Active
      h. Blue – Output Active
      i. White – Input & Output Active
   2. 1 x 300W output
   3. Built-in 70V
   4. Space-saving 1 RU design

5. Control Port:
   a. (1) RS-232 Communication port to facilitate SAFE System Communications or 3rd party device control such as a projector
   b. (1) Remote Control Port: Integration with LCD Wall Plate
   c. (1) XD Port, RJ45
6. Ethernet I/F: 10/100 Mbs
7. Line Inputs
   a. For PC, DVD audio, MP3, auxiliary mic, or other multimedia sources
   b. (1) Unbalanced input (3.5mm)
   c. (1) Balanced inputs RJ45 connector
   d. Internal Network Audio
8. Line outputs
   a. (1) Unbalanced (3.5mm) output
   b. (2) Balanced line output (RJ45 connector)
9. Signal-to-Noise Ratio >89dB @ 20Hz – 20kHz at Maximum Output
10. Input Sensitivity 780mV
11. Output Power: (3) 24v RJ45
12. 5 Band Equalizer
13. USB: Control and configuration via software. BLE Dongle for easy setup
14. Power Supply
    a. 100V – 120V/240V – 240V @ 300W power amplifiers
    b. PoE (PoE 802.11 af) Powers all electronics except for the 70v Speaker out Amplifier
    c. Both AC Power and PoE Power must be connected for unit to operate
15. Operating Temperature/Humidity -32 – 122 F (0- +50C) / 10-90%
16. Storage Temperature -40°C to 70°C/10-90% non-condensing

J. INTERCOM PAGING SYSTEM ADMINISTRATIVE KIOSK:
   1. The administrative Kiosk shall be customizable, flexible and provide full access to the intercom paging system.
   2. Kiosk shall be embed Android OS into the touch screen and only display the intercom interface.
   3. The supplier is required to provide a dedicated touch screen Kiosk for the front office, with a minimum size of 22” Diagonally. The Kiosk shall not require the district to provide any additional hardware, software or licensing. The Kiosk shall also provide a boom microphone attached to the screen that wires directly to the Kiosk.
   4. Administrative access to the system shall be browser based and shall also be capable of being any administrative computer.
   5. Functionality to provide full access to all features such as all call, paging groups, emergency tones, control music, WAV file distribution, test rooms, crisis mode, schedules, etc…

K. NETWORK INTERFACE
   1. Provide a Network Interface with performance as follows:
      a. Full-Duplex, Hands Free communications on Intercom Call
      b. Amplifier powered only by the PoE power source for emergency paging applications
      c. Mounting Bracket as required

d. Connections – The following connections shall be available:
   i. Line Output for connecting to auxiliary amplifiers
   ii. 2 External I/O Connections – Terminal Block
      1. Ability to support relay output for interface into other systems.
   iii. RJ45 for PoE Network Connection
   iv. Serial interface for connecting to other equipment or SAFE Compatible equipment.
e. 1 speaker connection
   i. The system shall provide a speaker connection which is powered exclusively by the PoE power from the network
   ii. Can power up to 2 speakers per device.
f. Network Connection
   i. The system shall have a network connection with PoE power.
   ii. PoE shall be present on the system to provide power for the amplifier during a power emergency.
   iii. Shall support LLDP-MED for two level 802.3 power negotiation and device information.
g. Integrated Network Based Communications
   i. The System shall support the following protocols:
      1. Directed UDP (User Datagram Protocol)
      2. Unicast Audio
      3. Multicast Audio
      4. SIP
      5. TCP Control
         a. Integrated Serial Tunnel over TCP
         b. The system shall have integrated SIP communications and be able to communication bi-directionally with any VoIP communications system that follows the standard SIP protocols.
         c. The system shall also have the ability to operate with multi-cast IP messages as well.
      6. Serial Gateway for Control via the network

L. NETWORK INTERFACE FOR 2-WAY INTERCOM
   1. Line Input - Internal Network Audio Line
   2. Outputs - 1 Unbalanced (3.5 mm) output
   3. Minimum Load Impedance - 4 Ohms
   4. Amplifier Type - 92% Efficient Class D for network audio only
   5. Continuous Power @ 1% THD - 25 Watts powered by PoE†
   6. S/N - >89 dB @ 20 Hz to 20 kHz at maximum output
   7. Protection Circuits - Thermal and short circuit protected
   8. PA Connector - Connects to public address system and mutes amplifier during announcements
   9. Input Voltage - 4.0 Volts RMS to 74 Volts RMS
      a. Control Port - RS-232, 3-pin screw terminal block header, RJ45 remote control port
   10. RS-232 communication port
   11. Intercom call, emergency alert, room microphone wall plate port (WPA-50x)
   12. Input/output (I/O) aux port for sense, strobe, etc.

13. Power Supply - PoE + 802.3af/at†
14. Temperature/Humidity
    a. Storage: -40 to 1580F (-400 to +700C) 10-90% non-condensing
    b. Operating: -32-1220F (0 to +500C) / 10-90%
15. Enclosure Type - Metal
16. Ethernet I/F - 10/100 Mbps
17. Power Input (Network) - PoE 802.3af/at†
18. Operating Temperature - 14 F to 1220F (-100C to 500C)
19. Protocols
    a. SIP RFC 3261 compatible
    b. UDP Directed Broadcast
    c. Multi-cast and VoIP enabled
20. Lineout Output Signal Amplitudes - 2.0 VPP maximum
21. Output Level - +2 dBm nominal
22. Total Harmonic Distortion - 0.5% maximum
23. Weight 1.3 lbs (589.67 g)
24. Dimensions 1.125 (H) x 9.19(W) x 3.56 (D) in. (28.57 x 233.43 x 90.42 mm

M. NETWORK INTERFACE SAFE ALERT EXTENDER AND 2-WAY INTERCOM
1. Line Input - Internal Network Audio
2. Line Outputs - 1 Unbalanced (3.5 mm) output
3. Minimum Load Impedance - 4 Ohms
4. Amplifier Type - 92% Efficient Class D for network audio only
5. Continuous Power @ 1% THD - 25 Watts powered by PoE†
6. S/N - >89 dB @ 20 Hz to 20 kHz at maximum output
7. Protection Circuits - Thermal and short circuit protected
8. PA Connector - Connects to public address system and mutes amplifier during announcements
9. Input Voltage: 4.0 Volts RMS to 74 Volts RMS
10. Control Port - RS-232, 3-pin screw terminal block header, RJ45 remote control port
    a. RS-232 communication port
    b. Intercom call, emergency alert, room microphone wall plate port (WPA-50x)
    c. Input/output (I/O) aux port for sense, strobe, etc.
11. Power Supply - PoE + 802.3af/at†
12. Temperature/Humidity
    a. Storage: -40 to 1580F (-400 to +700C) 10-90% non-condensing
    b. Operating: -32-1220F (0 to +500C) / 10-90%
13. Enclosure Type - Metal
14. Ethernet I/F - 10/100 Mbps
15. Power Input (Network) - PoE 802.3af/at†
16. Operating Temperature - 14 F to 1220F (-100C to 500C)
17. Protocols
    a. SIP RFC 3261 compatible
    b. UDP Directed Broadcast
    c. Multi-cast and VoIP enabled
18. Lineout: Output Signal Amplitudes 2.0 VPP maximum
19. Output Level +2 dBm nominal
20. Total Harmonic Distortion 0.5% maximum
21. Weight 1.3 lbs (589.67 g)

22. Dimensions 1.125 (H) x 9.19(W) x 3.56 (D) in. (28.57 x 233.43 x 90.42 mm) MS-375 Specifications*
23. Integrated XD Receiver Specifications
    a. System Frequency - XD Technology 1.9 GHz
    b. Coverage - Adjustable for optimal coverage from small classrooms to cafes, gyms, and other large spaces
    c. Microphone Type - Unidirectional electret condenser microphone
    d. Auxiliary Input Line level 35 stereo mini jack (monarural mix)
    e. Power Requirement - 24 VDC @ 130 mA Temperature Range 32 F - 104 F (0 C - 40 C)

N. CLAUDIA (Classroom Link Advanced Unit for Delivery of Instruction and Audio) Interface for Front Office
    1. The program distribution panel shall provide inputs for audio signals from radios, MP3 players, CD players, etc.
    2. The program distribution panel shall permit adjusting the volume of each source and monitoring of the source at the panel.
    3. The program distribution panel shall be equipped with a 7” capacitive touch screen interface that provides control of the sources, and streaming functions into the paging system. 800X480 Resolution
    4. The program distribution panel shall provide Bluetooth® connectivity from a source device
    5. Two Line Level 3.5mm inputs
    6. Two Line Level 3.5mm outputs
    7. Powered via USB C
    8. Gigabit Ethernet Connectivity
    9. Delivers audio on demand or on schedule to MS-300/MS-500 Devices on Network from inputs within the unit including line level, preloaded, and Bluetooth.
    10. Can be scheduled and controlled as part of bell schedule within the EPIC system.

O. ANALOG INTERCOM SYSTEM CABLING:
    1. West Penn
    2. Belden
    3. General Cable
    4. Mohawk
    5. Accepted substitute

P. INTERCOM PAGING SYSTEM VOLUME CONTROL:
    1. Volume control shall be capable of controlling the volume of up to one hundred-fifty (150) 1-way speakers.
    2. Volume control shall be mounted on a brushed stainless-steel single gang wall plate with the plate being embossed with a dial scale of “0 through 10.”
    3. Volume control shall be equipped with a skirted black knob with white position indicator.
    4. Volume control shall include a stainless-steel mounting box and hardware.

Q. INTERCOM PAGING SYSTEM CEILING SPEAKER.
    1. Ceiling Speaker Specifications – Utilize the following generally for all ceilings with ACT Type Ceilings throughout the building, unless noted otherwise on plans OR

installed in Gypsum Board Ceilings.FS-21 – Use for all common areas, NOT INCLUDING CLASSROOMS, with ACT Grid ceiling, unless noted otherwise on plans.

a. 2’ x 2’ Lay in style speaker
b. Vented Enclosure
c. 8 Ohm Nominal, 50W Continuous Pink Noise
d. Sensitivity - 88 dB (1W/1M)
e. Frequency Response 70 Hz - 15 kHz (-10 dB) 100 Hz - 14 kHz +/-2 dB)
f. Speaker back can meets UL2043 criteria for plenum installation.
g. Depth not to exceed 3.75”

2. SPO-300 – Use for all general use areas with gypsum board ceilings. Where speakers are noted as Pendant, utilize the SPO-300 with a Pendant Shroud. Coordinate shroud color with architect prior to ordering.
   a. Lay-in ceiling speaker shall consist of a white 13.5” grill, a speaker and integral back box or equivalent ceiling speaker with appropriate backbox, grille and tile bridge.
   b. Integrated 25/70/100V Transformer with tap settings accessible without disassembling speaker from 1.25W to 15W or 8Ohm bypass.
   c. The speaker shall be capable of handling minimum 50 watts continuous power.
   d. Sound pressure level at 1 meter on axis with a 1 Watt input shall be 96 dB.
   e. The frequency response shall be 86 Hz to 16 kHz.
   f. The baffle shall be constructed with a single piece of perforated steel with a white baked on acrylic enamel finish.
   g. Shall support seismic cabling from 3 points.
   h. The back box shall meet or exceeds UL 2043 for installation in a plenum space
   i. Approximate weight shall be 7.1 lbs. (2.49 kg).
   j. Basis of Design Audio Enhancement SP-0300.

R. INTERIOR INTERCOM PAGING SYSTEM SURFACE WALL SPEAKER:
   1. Wall speaker shall consist of a speaker and matched surface mount enclosure.
   2. The speaker, housing and hardware shall be electrically and acoustically matched for a frequency response of 65 Hz to 17 kHz.
   3. The speaker shall be 8” (20.32 cm) in diameter. and have a ceramic magnet weighing 4.8 ounces.
   4. Average sensitivity 92dB SPL, 1W/1M.
   5. Maximum output shall be 99dB.
   6. The baffle shall be constructed of 22 gauge steel with white baked hybrid epoxy.
   7. Maximum dimensions of the housing shall be 11 5/8” square and 4 1/8” deep.

S. INTERCOM PAGING SYSTEM PAGING HORN:
   1. The paging horn shall be a weather-resistant, high efficiency reentrant type horn speaker.
   2. The paging horn shall be equipped with an amplifier and externally accessible volume control.
   3. The paging horn shall include an adjustable swivel base.
   4. The frequency response shall be 275 Hz to 14 kHz.
   5. Dispersion shall be 90° horizontal and 90° vertical.
   6. Sound pressure level shall be 121 dB measured at 4 feet (1.22 m) on axis with an input to the amplifier module being -10 dBm at 1 kHz.

7. Distortion shall be less than 2.0% at rated output of 15 watts RMS.
8. Input impedance shall be 600 ohms nominal.
9. The amplifier shall operate on a -24 Vdc nominal, positive ground power supply.
10. Operating current shall be 900 mA at -24Vdc
11. Operating temperature shall be -20 to 55 °C (-4 to 131 °F).
12. Operating humidity shall be 0-95% noncondensing.
13. Dimension of the horn shall be 8" (20.3 cm) W x 8" (20.3 cm) H x 9:" (22.9 cm) D.
14. Approximate weight shall be 4.0 lbs (1.8 kg).

T. INTERCOM PAGING SYSTEM VOLUME CONTROL
   1. The volume control must support a rotary selector switch with 11 positions.
   2. Volume control shall be white in color and be sized to fit a decora style plate.
   3. Inputs on control shall support incoming 25/70V signal on both the + and – with outgoing signal on + and -. Support for up to 12 AWG Wire.
   4. 25W RMS
   5. Basis of Design EPIC-V70v

U. CLASSROOM SOUND AMPLIFICATION SYSTEM (CSAS) EQUIPMENT: OPTIMUM AMPLIFIER WITH INTEGRATED XD RECEIVER:
   1. Provide a fully PoE Powered Receiver/Amplifier with ability to provide functions described above with performance as follows:
      a. Audio Power: 30 watts RMS mains powered amplifier
      b. 92% Efficient Class D Amplifier
      c. 1% percent THD across full frequency range of amplifier
      d. Frequency Response: 20 Hz to 20 kHz
      e. Power Requirements: PoE 802.3af/at 25.5W Maximum
      f. Shall support LLDP-MED for two level 802.3 power negotiation and device information.
      g. Signal-to-noise: >89dB
      h. Integrated mounting tabs
      i. Thermal and short circuited protected
      j. Integrated 3 channel DECT RF Receiver
   2. Controls:
      a. The primary control of the system shall be done through the teacher microphone.
      b. The following functions shall be available via USB connection for setup during installation:
         i. Input Control for multi-media sources and mixed XD source
         ii. Equalizer Controls
            a. 5 Band Digital Equalizer
         iii. Discreet Output volume controls for each input
      c. RS-232 Control
         i. Provide 4:RS-232 ports which provide pass-through control of a downstream device like a projector, etc.
         ii. RS-232 processor shall be capable of differentiating between commands destined for the amplifier, and responding to those commands, and commands intended for the downstream and passing those commands through to the secondary RS-232 port
         iii. Command pass through shall be bi-directional

d. Connections – The following connections shall be available:
   i. Five (5) Multi-Media inputs
   ii. Dedicated Line output – for Assistive Listening Device Connection
   iii. Color Coded Connection
   iv. Ethernet Connection (8P8C RJ45 with PoE Power)
   v. 8P8C RJ45 Connection for Intercom Paging Wall plate
   vi. Support for Touch Based Wall Controller on Remote Port
   vii. General Purpose I/O Output on 8P8C RJ45

3. Integrated DECT Technology RF Receiver The Receiver shall utilize DECT technology. DECT is a radio technology for voice applications. DECT is ideal for the classroom because the use of both frequency and time domain is ideally suited to smaller areas with a large number of users. In each classroom, it will be an independent system, with all necessary electronics to support the receiving & pairing functionality mounted on the wall near the amplifier or in the ceiling. The receiver will be connected to the amplifier through a universal twisted pair cable, using balanced audio connections. Power for the receiver shall be provided through the same cable as the balanced audio connections.
   a. The receiver shall provide the following functionality. These features shall be included on board the receiver, and not require any external support to perform these functions.
      i. Three Channel DECT based reception
      ii. Pairing Button for Linking microphone to the receiver
      iii. Remote control of all three microphone channels
      iv. Advanced Feedback Blocker
         a. The system shall have the ability to actively control feedback. This shall be done via an analog circuit that provides up to five active filters to control specific frequencies,
         b. The Feedback Blocker shall also have the ability to lower the overall of the system by up to 6dB, during a user error situation where the overall system gain is manually turned up too high
         c. The Feedback Blocker system shall automatically remove the filtering upon resolution of the user-initiated error condition
            1. The Feedback Blocker shall be of an analog design – in order to avoid the detrimental effects of digital sampling, only analog systems shall be considered in order to implement this feature.
      v. Emergency Alert Function
         a. The system shall provide a trigger signal when the teacher presses and holds a button on her transmitter for more than two (2) seconds.
         b. The system shall be capable of providing a visual indication of three (3) red LED’s when the teacher initiates a trigger signal
         c. The system shall also be capable of receiving a trigger acknowledgement signal back from an external source, and altering the visual indicator from three (3) red LED’s to two (2) Green and one (1) red LED
      vi. Recording Function
         a. The system shall provide for a secondary notification that can be used for future applications such as signaling an NDVR (Network Digital Video Recorder) to start a recording
      vii. Control System Integration

a. The system shall have on board the capability of being controlled via RS-232 protocol.

viii. The system shall also have the capability of broadcasting RS-232 commands when the teacher presses the up/down volume controls on their microphone

b. Power Requirements: Inegrated power from PoE, receivers requiring secondary power not allowable.
c. Operating Frequency – 1.9 GHz Band
d. Receiver Type: DECT
   i. Controls: System shall have available the following controls
      a. Channel 1 Volume Control – Fully controllable from the teacher microphone remotely through the DECT system
      b. Channel 2 Volume Control – Fully controllable from the teacher microphone remotely through the DECT system
      c. Auxiliary Input Volume Control – Fully controllable from the teacher microphone remotely through the DECT system
      d. Alert Controls on Teacher Microphone – Two (2) buttons on the sides of the microphone
      e. Recording Control on Teacher Microphone – One (1) button on the front of the microphone

V. TEACHER BODY PACK TRANSMITTER AUDIO ENHANCEMENT STM-24 – PROVIDE ONE PER CLASSROOM
   1. Provide a body pack transmitter with performance as follows:
      a. Operating frequency – 1.9 GHz - DECT
      b. Audio distortion: <1.0% (±40kHz deviation @ 1kHz)
      c. Integrated microphone
      d. Internal charger circuit
      e. USB-C Charging Port – shall be capable of being charged from a standard USB port – including a port on a computer
      f. Power button functionality
      g. Power on – turns the microphone on when microphone is off and button is pressed
      h. Mute – mutes the microphone when pressed and released once microphone is turned on
      i. Power Off – push and hold to turn power off
   2. Additional Function (F) Button Features
      a. SAFE Alert Functionality – Provides security alert when the two (2) buttons on the sides of the microphone are pressed and held for more than two (2) seconds
      b. Recording Functionality – Provides simple logic signal when the REC button is pressed on the face of the microphone which activates terminals on the receiver
      c. Intercom Call Button– Initiates a 2-way intercom call across the network
      d. Confirm Room Response Button – allows the teacher to indicate to the front office that they have completed their assigned procedures for the classroom during a lockdown emergency.
   3. External Inputs
      a. Provide an input for an external microphone

   b. Provide an input for a stereo auxiliary input (Mixed to Mono in microphone)
4. Microphone Element – The teacher microphone shall utilize a 10mm microphone element to insure optimum frequency response and maximum pickup of teacher's voice.
5. Power 1 - LiON Long Life Battery (Systems using two (2) batteries will not be considered)
   a. Battery style shall be common between handheld microphone and teacher transmitter. Systems that use different batteries in the handheld vs teacher microphone shall not be considered.
6. Provide remote volume control for the system from the teacher's transmitter
   a. Volume control via the wireless microphone system to allow the teachers to remotely adjust their own volume level.
   b. Volume control for the other channel from the teacher's microphone
   c. Volume control for the auxiliary inputs from the teacher's microphone
   d. Side Alert Buttons – Provide remote control functionality that allows for enabling additional multi-use functions from the teacher microphone.
   e. REC Button – Provide a button on the face of the microphone that can be used for multiple purposes.

W. STUDENT HANDHELD TRANSMITTER SSH-24 – PROVIDE ONE PER CLASSROOM
1. Operating frequency – 1.9 GHz - DECT
2. Integrated microphone
3. Internal charger circuit.
4. USB-C Charging Port – must be capable of being charged from a standard USB port – including a port on a computer
5. 1/8" (3.5mm) auxiliary input connection - Provide an input for a stereo auxiliary input (Mixed to Mono in microphone)
6. Power 1 - LiON Long Life Battery (Systems using two (2) batteries will not be considered)
7. Battery style must be common between handheld microphone and teacher transmitter. Systems that use different batteries in the handheld vs teacher microphone will not be considered.
8. Operational Modes – the handheld microphone must be equipped with two operational modes
   a. Push-to-Talk Mode – the user simply depressed the power button to talk, and when released the microphone automatically turns off – this provides for a number of separate microphones to be used consecutively and greatly reduces the chance of channel interference
   b. Power-On Mode – The user depresses the power button, and slide is vertically into the on position – this holds the microphone in the on state for continuous operation
   c. Microphone Element – The Handheld microphone shall utilize a 10mm microphone element to insure optimum frequency response and maximum pickup of teacher's voice.

X. CLASSROOM SPEAKER PERFORMANCE SPECIFICATIONS

1. WS-09 – Use for Wall Mounted Speakers in Classrooms and Corridors where

shown on plans.
   a. Surface Mounted Speaker with Integrated U style Bracket
   b. 2-Way system with vented enclosure
   c. 8 Ohms nominal
   d. 88 dB 1 Watt/1 meter
   e. Frequency Response 80 Hz to 20 kHz +/-2dB
2. FS-22 – Use for all areas with ACT Grid ceiling, unless noted otherwise on plans.
   a. 2’ x 1’ Lay in style speaker
   b. Vented Enclosure
   c. 8 Ohm Nominal, 50W Continuous Pink Noise
   d. Sensitivity - 88 dB (1W/1M)
   e. Frequency Response 70 Hz - 15 kHz (-10 dB) 100 Hz - 14 kHz +/-2 dB)
   f. Speaker back can meets UL2043 criteria for plenum installation.
   g. Depth not to exceed 3.75”

Y. CLASSROOM INTERCOM WALL PLATES WPA-701 - 705
1. Wall plates expand the communication between classrooms and the office.
   a. WPA-702
      i. Microphone
      ii. Green Button for Intercom Call
      iii. Red button to Initiate an Emergency Alert
2. Reference technology floor plans for device locations
3. Wall plate to match lighting and receptacle plates. Refer to Electrical Specifications.
4. 8P8C (RJ45) connection

Z. AMP INTEGRATED CLASSROOM INTERCOM CALL BUTTON WBA-704/702
1. Reference technology floor plans for device locations
2. Wall plate to match lighting and receptacle plates. Refer to Electrical Specifications.Green button for intercom call
3. 8P8C (RJ45) connection

AA. CLASSROOM INTERCOM, EMERGENCY ALERT & A/V TOUCH PANEL CONTROL – AUDIO ENHANCEMENT – CAPACITIVE TOUCH CONTROL MODULE (ITC2-M)
1. For all locations where an MS-x00 Classroom Amplifier/Network Interface is specified.
2. Coordinate with electrical contractor to make sure a double gang electrical box is available – or use an acceptable double gang mounting ring
3. Provide a simple, standardized control interface for projectors, monitors, display devices, or other AV devices in a compact double-gang form factor. A CUSTOMIZABLE INTERFACE which will allow for a variety of configurations including full color graphical representations of equipment and buttons as well as multi-page capability.
4. Multiple School Based Configurations for Emergencies
5. SAFE Room lockdown, secure in place and reporting.
6. Package Type: Double-Gang Back Lit Capacitive Touch Screen
7. Dimensions: 4.5” (L) x 4.5” (W) x 1.25” (D)

PART 3 – EXECUTION

3.01 INSTALLATION

A. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturers wiring diagrams and these specifications. The contractor shall furnish all conduits, cable tray, surface raceway, wiring, outlet boxes, junction boxes, cabinets etc… as well as all required miscellaneous materials and labor necessary for the complete installation of the cable support / pathway system.
B. Wiring may be opened wired in cable tray or "J" hooks above accessible suspended lay-in ceilings. Wiring in walls or exposed on walls shall be enclosed in EMT conduit. Cable shall be supported at a minimum of every 5’.
C. A nylon pull string shall be installed in each conduit / surface raceway run.
D. Any locations where flexible metal conduit has to be used, it shall terminate to a junction box on both ends and be securely anchored for proper support.
E. Conduit indications in the drawings are a minimum standard.
F. All equipment shall be mounted with sufficient clearance for observation, servicing, testing and accessible from either the floor or ladder. If any device is installed in a location that is deemed inaccessible by the Owner and or Architect / Engineer, it will be moved to an accessible location by the contractor at no additional cost to the Owner.
G. The contractor shall supply access panels where required and as defined by the Architect / Engineer. Contractor to notify the Architect / Engineer immediately if this issue arises during construction.
H. All penetration of floor slabs and firewalls shall be fire stopped in accordance with all Federal, State and local codes.
I. All wiring shall be color coded per National Electrical Code requirements and standards.
J. All conduit ends shall have plastic grommets to protect cable from damage due to sharp edges on the conduit.
K. Mounting heights and mounting requirements shall be as shown on the drawings.
L. All junction boxes shall be clearly marked and labeled for easy identification. Flexible connectors shall be used for all devices mounted in suspended lay-in ceiling panels. All conduits, outlet boxes, junction boxes and panels shall be securely installed and anchored with appropriate fittings and connectors to insure positive grounding throughout the entire system.
M. No wiring except that of this system shall be installed in this systems cable support / pathway system.
N. Wiring splices shall be made only in designated junction boxes and tagged on both sides of the junction. The junction shall be made on clearly labeled, insulated terminal strip. Transposing or changing the color-coding of the cable is not permitted. Wire nut connectors are not acceptable. System cable and the 120vac power cable shall be in separate conduits.
O. It shall be the responsibility of the contractor to wire and connect ancillary devices to this system as listed in this specification section.
P. Any circuits leaving the building to the outside shall be protected by the appropriate transient protection devices as required by the manufacturer to avoid damage to the system if transient surges are inducted on to these circuits (i.e., lighting strikes).
Q. Contractor to provide in-wall bracing support for all devices that are to be wall mounted to walls that are not masonry block walls.

R. All devices shall be protected throughout the entire project. All devices shall be kept free of construction dirt and debris during the entire project. The contractor shall be responsible for replacing at no additional cost to the Owner any devices that are deemed dirty or unsuitable for use by the Owner and or Architect / Engineer throughout the entire project.
S. All cabling and devices shall be labeled with type written labels. Device labels and cable labels shall match the labeling information that is documented on the as-built drawings. Contractor to coordinate labeling schemes and labeling requirements with A/E prior to commencing with final labeling. Labeling system shall be by Brady or Panduit.

3.02 INSTALLER QUALIFICATION

A. Installer shall have a BICSI RCDD (Registered Communication Distribution Designer) on staff.
B. Installer shall have an Avixa CTS (Certified Technology Specialist) on staff.
C. Installer shall be an Authorized Audio Enhancement reseller and be certified in EPIC System, level 1 and level 2.
D. Installer shall hold an appropriate State Contracting or Electrical License as required.

3.03 FIELD QUALITY CONTROLL

A. The system shall be installed and fully tested as listed in these specifications. The system shall be demonstrated to perform all features and functions as listed in these specifications at a minimum.

3.04 TESTING

A. Reports of any field-testing during the system installation shall be forwarded to the Owner and Architect / Engineer for review and comment.
B. Each individual system operation on a circuit-by-circuit basis shall be tested for its complete operation. Any devices that are to be connected to the system shall be tested as specified. Device locations and address / circuit numbers shall be documented on the as-built drawings as well as the wiring configuration of the device circuits. Device locations shall be field verified by the contractor and shall include any costs in the bid that is relating to all devices being connected to the system. The procedure for testing the entire system shall be set forth in these specifications and with the consent and approval of the Architect / Engineer, Owner and equipment manufacturer. Confirm testing requirements with the Owner and Architect / Engineer prior to commencing with system testing.
C. Perform the tests and adjustments necessary to assure the satisfactory quality and level of performance of the system under normal operating conditions.
D. Establish the normal settings for all controls and devices for all system operational and functional features and record the same for future reference. All levels shall be set and recorded in the as-built documentation for optimum system performance.
E. The installation technician from the installer / manufacturer shall perform all system tests as specified. Perform all tests in the presence of the Owner, Architect / Engineer and any designated personnel as deemed necessary by the Owner or Architect / Engineer. This test shall be performed with the devices at their operational location and under

normal operational conditions. Bench or default settings for devices are not acceptable. All test and test report costs shall be included in the contractors bid. A checkout report shall be generated by the installation technician and submitted to the Owner and Architect. The report shall include but not be limited to the following:

1. A complete list of all equipment installed with corresponding serial numbers.
2. Indication that all equipment is properly installed, functions and conforms to the specifications.
3. Serial numbers, locations by device and model number for each installed device.
4. Technicians name, specified certification credentials and date of system test.
5. Any additional information as deemed necessary by the Owner and or Architect / Engineer.

F. A substantial completion test shall be performed before the final test and acceptance of the system by the Owner and Architect / Engineer. At the time of the substantial completion system test, provide to the Owner or his representative an oral explanation of the operation and maintenance of the system. Before starting the tests and adjustments listed above, the contractor shall submit the following to the Owner and the Architect / Engineer for review during the substantial completion test:
   1. Preliminary as-built wiring diagrams of the entire system.
   2. Preliminary copy of the operation and maintenance manuals.
   3. Preliminary copy of the system test report form.

G. If no system performance issues arise during the substantial completion test that need to be repaired by the installation contractor, this can be approved as the final system test by the Owner and or Architect / Engineer. If there are performance issues that arise that do need to be repaired, another complete and comprehensive system test shall be scheduled and performed to show that the necessary repairs have been properly addressed. These tests shall be performed at no cost to the Owner until a time that the system is shown to be in complete operating condition as approved by the Owner and Architect / Engineer.

H. A commissioning report of all the tested functionality of the system shall be provided by a certified L2 technician by the manufacture or by the manufacture themselves.

3.05 DOCUMENTATION AND TRAINING

A. After the final system test and the Owner and Architect / Engineer has accepted the system to be in the proper operating condition, the contractor shall compile and provide to the Owner three (3) complete operation and maintenance manuals and three (3) sets of as-built drawings on the completed system to include but not be limited to the following:
   1. Operating and maintenance instruction sheets for each piece of equipment showing the proper operation and maintenance of the system component.
   2. Individual factory issued operation and maintenance catalog brochures of all equipment and components that were installed as part of the system. Advertising brochures, submittal data sheets and operational materials shall also be included but shall not be used in lieu of the required technical manuals.
   3. Complete as-built wiring diagrams and floor plan drawings of the complete system installation showing how the system was installed. These drawings shall include any devices that are connected to the system with their address / circuit number documented as well as the wiring configuration of all device circuits. The as-built drawings shall be an updated and revised copy of the submittal drawings showing

all modifications made during the installation of the system. A copy of the as-built drawings in electronic format in AutoCAD Release 2014 or higher will be forwarded on to the Owner and Architect / Engineer for archiving in the operation and maintenance manuals.

4. A statement of guarantee including the date of the termination of the warranty as well as the phone number of the person to be called in the event of equipment failure.
5. A cover letter, for the above mentioned tests, certifying the entire system and its components, application and installation meets or exceeds the recommendations of the manufacturer, all applicable code requirements and test specifications.

B. The final and installed version of the system software shall be provided to the Owner on a via electronic means the operation and maintenance manuals. These manuals shall be used for final check out of the system.

END OF SECTION 27 51 00

SECTION 27 53 13 – GPS WIRELESS CLOCK SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. This Section specifies materials and accessories for the IP-PoE clock system.

B. Section Includes:

1. (S)NTP server/master clock;
2. Elapsed timer;
3. Secondary analog IP-PoE clock;
4. Secondary digital IP-PoE clock.

1.02 RELATED REQUIREMENTS

A. Section [27 06 10 – Voice Data System].

1.03 REFERENCE STANDARDS

A. Federal Communications Division (FCC)

1. Part 15 - Code of Federal Regulations.

B. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 802.3af-[1998], Standard for Information Technology - Telecommunications and Information Exchange Between Systems.

C. National Fire Protection Association (NFPA).

1. NFPA 70E-[2012], Standard for Electrical safety in the Workplace.

D. US Green Building Council (USGBC).

1. LEED® NC Version 2.2-[2009], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations.

E. Underwriter’s Laboratories (UL)

1.04 ADMINISTRATIVE REQUIREMENTS

A. Co-ordination: Co-ordinate work of this Section with communications and electronics work and with work of other trades for proper time and sequence to avoid construction delays.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

A. Make submittals in accordance with Contract Conditions and Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit product data including manufacturer’s literature for clock system materials and accessories, indicating compliance with specified requirements and material characteristics.

1. Submit list on clock system manufacturer’s letterhead of materials and accessories to be incorporated into Work.
2. Include product name.
3. Include preparation instructions and recommendations, installation methods, and storage and handling requirements.
4. Include contact information for manufacturer and their representative for this Project.

C. Shop Drawings: Submit shop drawings with information as follows:

1. Diagram of proposed system showing system platform appliance, communication pathway, and schedule of individual device locations.
2. Include wiring diagrams detailing wiring for power, signal and control and showing typical connections to equipment and devices.
3. Indicate integration with the Owner's network and servers. Include line diagram of network relationships.
4. Show system power requirements.

D. Samples:

1. Submit one sample of each type of device used on project. Samples will be returned to Contractor for incorporation into Work after Consultant’s review.

E. Test Reports:

1. Submit evaluation and test reports or other independent testing agency reports showing compliance with specified performance characteristics and physical properties.

F. Subcontractor Experience: Submit verification of communication and electronics subcontractor’s experience.

G. Manufacturer’s Authorization: Submit verification that of communication and electronics subcontractor’s authorization from clock system manufacturer to perform Work of this section.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Supply maintenance data for clock system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

B. Record Documentation: In accordance with Section 01 78 00 - Closeout Submittals.

1. List materials used in clock system work.
2. Warranty: Submit warranty documents specified.

1.07 QUALITY ASSURANCE

A. Communications and Electronics Subcontractor Quality Assurance:

1. Work experience of [3] years minimum with work similar to work of this Section.
2. Manufacturer’s authorization to perform work of this section.

B. Supplier’s Accreditation: Use only suppliers accredited by clock system manufacturer.

C. Supplier’s Maintenance Requirements:

1. Ensure local supplier has adequate facility for storage of spare parts for clock system.

1.08 DELIVERY STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Deliver material in accordance with Section 01 61 00 - Common Product Requirements.
2. Deliver materials and accessories in clock system manufacture’s original packaging with identification labels intact and to suit project.
3. Ensure clock system materials are not exposed to moisture during delivery.
4. Replace damaged clock system materials.

B. Storage and Handling Requirements: Store materials off ground in dry location and protected from exposure to fumes and harmful weather conditions and at temperature conditions recommended by manufacturer.

1. Store in original packaging until installed.

C. Packaging Waste Management:

1. Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities.

1.09 WARRANTY

A. Project Warranty: Refer to Contract Conditions for project warranty provisions.

B. Manufacturer's warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not intended to limit other rights Owner may have under Contract Conditions.

C. Warranty period: 2 years commencing on Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Manufacturer: Sapling Inc., 670 Louis Drive, Warminster, Pennsylvania 18974, USA, Phone: 1-215-322-6063, URL: www.sapling-inc.com.
B. Acceptable substitutions: Three-Sixty, American Time, other engineer and owner approved alternates.

2.02 SYSTEM REQUIREMENTS

A. Ensure clock system components are designed to operate as part of complete system and include "fail-proof" design to ensure power interruption does not cause system failure.

B. Ensure system synchronizes all clocks and devices to each other.

C. Ensure system operates utilizing Power over Ethernet to IEEE 802.3af.

D. Ensure system works with monitoring software for system controls from one location and including options as follow:

1. Mark clocks as priority for quick viewing;
2. Uploading and downloading configuration capabilities;
3. Sending numeric messages to digital clocks;
4. Sending countdown functions to digital clocks;
5. Sending alphanumeric messages to digital clocks;
6. Displaying which clocks are not receiving (S)NTP time.

E. Ensure system monitor is run on PC on same network as IP-PoE system.

1. Server installation is not required.

F. Ensure system is capable of operating without physical servers and software.

G. Ensure each clock in system has built-in web interface for programming.

H. Ensure system is capable of programming clocks immediately upon receipt of signal.

1. Analog and digital clocks automatically correct themselves on receipt of signal.
2. Include built-in closed-loop system in analog clocks capable of allowing clocks to detect position of hands and bring clocks to correct time even if clocks are manually altered.
3. Ensure analog clocks have diagnostic function capable of allowing user to view how long since clock received a digital signal.
4. Ensure analog clocks are capable of functional tests of electronics and gears.

I. Ensure each individual product is bench tested at manufacturer's facility.

1. Random testing is unacceptable.

J. Ensure each product is designed, assembled and tested in United States of America.

K. Basis of Design: Sapling Inc., IP-PoE Clock System.

2.04.1 SECONDARY CLOCKS

A. Analog Clock: 16-inch low profile black ABS housing with shatterproof polycarbonate cover, 12-hour format, suitable for wall mounting onto standard single gang electrical box.

a. Basis of design: Sapling Inc., SAP Series Analog IP-PoE Clock.

B. Digital Clocks: To UL and cUL, designed for IP-PoE system.

a. Display: High-efficiency red LED numeral display with 6 digits.
   i. Display size: 4.0 inches
   ii. Format: 12 hour.
   iii. Brightness: Ensure display has four level of brightness adjustment.
   iv. Bezel:
      1. Smooth Surface, red colored.
      2. Bezel size: 6.75 x 13.31 inches.
      3. Visibility: 100 feet minimum.
   v. messaging capabilities such as "BELL" and "Fire" from software on the network;
   vi. Alternating Time/Date functionality.

b. Power Requirements: Power over Ethernet (PoE), 48 V DC.
c. Clock mounting: Metal, flush mount housing.
d. Built-in Web Interface includes feature options as follow:
    i. Password protected interface. Open access is unacceptable;
    ii. Naming of the clock;
    iii. Selecting time interval clock receives NTP time;
    iv. Bias seconds configuration for altering correct time +/- 9999 seconds;
    v. Setting GMT offset for time zone configuration;
    vi. 12/24 hour mode;
    vii. Select all IP settings;
    viii. DHCP capability;
    ix. Server redundancy capability. Up to 10 servers can be used as backup in case of failure.
    x. Domestic and International Daylight Saving Time capability;
    xi. E-mail alerts for situations as follow:
        1. If NTP synchronization received is larger than specified interval
        2. If time sync received is larger than specified interval
        3. If clock has been reset
        4. If count up has been activated (if clock is interfacing with an elapsed timer control panel)
        5. If countdown has been activated (if clock is interfacing with an elapsed timer control panel).
    xii. Four levels of brightness;
    xiii. American or European time format [MM:DD:YY][DD:MM:YY]
    xiv. Brightness scheduling capability:
    xv. Ensure clock is capable of changing brightness level two times minimum throughout day
    xvi. Ensure clock brightness is selectable: Off, Low, Medium, or High
e. Basis of design: Sapling Inc., SBP 3100 Series Digital IP-PoE Clock.

2.05 ACCESSORIES

A. Conductor and cables: In accordance with Section 27 06 10.

D. Data Circuits: I accordance with Section 27 06 10.

F. Hangers and Supports: In accordance with Section 27 06 10.

2.06 SOURCE QUALITY CONTROL

A. Ensure clock system components and accessories are supplied or approved in writing by single manufacturer.

2.07 PRODUCT SUBSTITUTIONS

A. Substitutions: In accordance with Section 01 23 13 - Product Substitution Procedures

PART 3 - EXECUTION

3.01 INSTALLERS

A. Use only installers with 2-years minimum experience with work similar to work of this Section.

B. Ensure all clock system components are installed by single communications and electronics subcontractor.

3.02 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for clock system installation in accordance with manufacturer's written recommendations.

1. Visually inspect substrate in presence of Consultant.
2. Ensure surfaces are free of snow, ice, frost, grease and other deleterious materials.
3. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

B. Start of clock system installation indicates installer's acceptance of substrate installation conditions.

3.03 INSTALLATION

A. Install IP communication clock system in accordance with manufacturer's written recommendations and in accordance with NFPA 70E.

B. Integrate clock system with Owner's electrical and communications network.

C. Install wiring in accordance with requirements of local Authority Having Jurisdiction.
   1. Do cabling in accordance with Section 27 06 10.

D. Conceal wiring except in unfinished spaces and as approved in writing by Engineer.

E. Install clocks only after painting and other finish work is completed in each room.

F. Install clocks and other devices square and plumb.

3.04 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with Section 01 45 00 - Quality Control.

3.05 SYSTEM STARTUP

A. At completion of installation and before final acceptance, turn on equipment and ensure equipment is operating properly, and clock system devices and components are functioning.

B. Evaluate and test each device in clock system on room-by-room basis using factory-trained technicians.
   1. Fix or replace devices which fail test or are functioning incorrectly.
   2. Submit evaluation and report showing results of room-by-room tests and overall system compliance within 3 days of testing being carried out.

3.06 CLEANING

B. Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.

3.07 DEMONSTRATION AND TRAINING

A. Arrange system demonstration and training session for Owner's operation and maintenance personnel.
   1. Allow Owner and Consultant 14 days minimum advance notice before training session.

B. Break down system demonstration and training session into logical segments for Owner's operations and maintenance personnel.

C. Train Owner's maintenance personnel in procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of clock system.

3.09 PROTECTION

A. Protect installed products and accessories from damage during construction.

B. Repair damage to adjacent materials caused by clock system installation.

END OF SECTION 27 53 13

SECTION 27 53 19 – BDA (BI-DIRECTIONAL AMPLIFIER) TESTING

1 Scope of Services

Contractor will perform testing of Fayette County STEM Academy (new construction) in order to determine existing coverage.

1.1 Coverage Baseline Testing

RF coverage using this test will be verified by capturing Received Signal Strength Indicators (RSSI) readings inside of the building under test.

Testing shall be performed on a grid system with a 25'x25' grid overlaid onto the floor plan of the building. Grid cells may be adjusted to achieve the minimum required number of test points and to reasonably accommodate building structure (walls, mechanical areas, etc.) and still allow for movement through the grid cell. Tests will be taken as close to the center of the test grid as possible. Testing shall include all areas of the building, elevators, basements, multi-level basements, and stairwells will all be included as test locations if they fall into the approximate center of any test grid.

Testing will be performed with a calibrated spectrum analyzer tuned to the primary frequency in use by the local AHJ or other designated agency. Test data will be recorded as the tester moves through the building according to the gridded test plan. Once test data has been collected from all available test points within the building, Contractor will deliver a report detailing the results captured for each floor in the building. RSSI measurements below -95dBm are considered inadequate coverage per IFC 510 guidelines. The Owner, Architect, or Engineer may attend all testing at their discretion, but all test procedures will be performed by Contractor personnel.

Contractor shall develop the floorplan grid as required to meet requirements of this test.

1.2 Testing Procedure

- The test team will enter the building and select distributed test locations according to the gridded floorplan
- A measurement for each test point is recorded on the PCTel Seehawk Touch device.
- Testing will continue using the same procedure for each test point until all accessible test points within the building have been tested.
- Any inaccessible test points will not be included in the reliability calculation for the building

1.3 Downlink (Base to Portable) Testing

This test will require the following:

- PCTel Site Survey Tool kit, consisting of a PCTel iBFlex Spectrum Annalyzer coupled with a PCTel Seehawk Touch tablet

.1 Downlink Grid Testing

- Move to as close to the center of a grid location as physically possible.
- Record the average RSSI reading using the PCTel Seehawk Touch interface

1.4 Review and Retesting

If test results vary an excessive amount, or if the testing shows less than adequate testing results, the equipment will be examined by the Vendor team members and if errors or deficiencies are found they will be corrected and logged.

1.5 Reporting

A detailed report will be compiled and provided depicting the RSSI measurements in each grid in an overlay of the building floor plans. The report will provide color coded indications of grids that either pass or fail for a minimum of -95dBM signal strength.

END OF SECTION 27 53 19

SECTION 27 53 19 - EMERGENCY RESPONDER COMMUNICATION ENHANCEMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: This performance-based specification section includes labor, material, and equipment to design, furnish, install and test a complete and operating In-Building Emergency Responder Communication Enhancement System for the purpose of amplifying and distributing radio signals in areas of the building with inadequate coverage. The radio signals and frequency bands shall be those in use by the Emergency Responders serving this facility.

B. Section Includes:

1. Preliminary RF Coverage Assessment.
2. Bi-Directional Amplifier.
3. Battery Back-up Unit.
4. Donor and Distribution Antennas.
5. Annunciator.
6. Passive RF Devices.
7. Cabling.

1.3 REFERENCES

A. Abbreviations and Acronyms:

1. AHJ: Authority Having Jurisdiction.
2. BDA: Bi-directional amplifier.
3. DAQ: Delivered Audio Quality.
4. DAS: Distributed Antenna System.
5. ERCES: Emergency Responder Communication Enhancement System.
6. FCC: Federal Communications Commission.
7. LMR: Land Mobile Radio.
8. RF: Radio Frequency.

B. Definitions

1. Backbone (Riser): A communications cable in an in-building ERCES that carries RF signals that are required to make the overall system operational from the donor

antenna signal source, through the amplifiers, and up to the connection point of the distribution antenna cables.

2. Critical coverage area: An area designated as critical by the AHJ, such as fire command centers, fire pump rooms, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations.
3. Distribution Antenna Cable (Feeder): A communication cable that carries RF energy in both directions along its length to distribution antennas in one or more places in a building.
4. Frequency Holder: The entity or the person that's been issued the license to operate those frequencies by the FCC.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. Federal Communications Commission (FCC):
   a. FCC 47 CFR Part 90.219 “Use of Signal Boosters in Private Land Mobile Radio Networks”.
2. Underwriters Laboratories (UL):
   a. UL 2524, “Standard for In-Building 2-Way Emergency Radio Communications Enhancement Systems”.

1.4 COORDINATION

A. Coordinate system scope and layout requirements, attachment methods, and envelope penetrations with architectural and MEP roof plans, elevations, and sections.

B. Coordinate installation of equipment supports and roof penetrations with Division 07 Section "Roof Accessories”. Do not invalidate roof warranty.

1.5 SEQUENCING

A. Prior to testing and operating the ERCES, obtain written consent from the AHJ and frequency license holder(s).

1.6 SUBMITTALS

A. Preliminary RF Coverage Assessment.

B. Product Data: For each type of product.

C. Shop Drawings: Provide the following.

1. Floor plans and ceiling plans showing accurately scaled components and spatial relationship to associated equipment. Include mounting heights with all equipment labels.

2. Include equipment locations, routing of the distributed antenna system, cabling, antennas, power connections, splitters, couplers, filters, amplifiers, grounding, lightning protection, fire alarm connections, and routing of all cabling.
3. Include building elevation depicting the location of any outdoor antennas associated with the proposed system. Include height of antenna centerline above building, orientation, and location of all external grounding connections and lightning/surge protection.
4. Include roof attachment and penetration details, coordinated with roof installation warranty.
5. Include enlarged plan views of Equipment Rooms housing head-end and or other consolidated equipment showing all enclosures required for the system. Indicate emergency power sources, location and circuit requirements both AC power and battery power.
6. Include uplink and downlink budget calculations.
7. Include calculations for battery run time.
8. Wiring Diagrams: Detailed one-line schematic wiring diagrams of the system and the interconnection wiring.

D. Delegated Design Submittals: Indicate compliance with performance requirements and design criteria listed herein, including analysis data signed and sealed by qualified professional responsible for their preparation.

1. Provide a copy of the AHJ and frequency license holder technical criteria including a list of all channels and frequencies used.

E. Test Plan. Description of the cable testing procedures, approved by AHJ, to be used including equipment to be used and applicable testing standards.

F. Test and Inspection Reports

1. Include documentation of all testing procedures and findings.

G. Qualification Data: For qualified Designer and Installer.

H. Closeout Submittals

1. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:
   a. Final test results.
   b. Signed product certificates certifying system complies with specified performance requirements.
   c. FCC License holder approval letter.
   d. FCC repeater registration documentation.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Five continuous years, minimum, design and manufacture of the systems specified.

2. Manufacturing facilities certified to ISO 9001 International Quality Standard with third-party certification verifying quality assurance in design/development, production, installation, and service.
3. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, maintenance, emergency repairs to equipment, and response times less than eight hours.

B. Installer Qualifications:

1. Manufacturer's authorized representative who is trained and certified by the manufacturer for installation and testing of the specified product.
2. Minimum of five years successful installation experience with Projects of similar size and complexity.
   a. Upon request, be able to provide a minimum of three reference accounts at which similar work, both in scope and complexity, have been completed by The Contractor within the last three years.
3. Project Personnel Requirements: Installer must have the following certified full-time employees on staff and assigned to the project:
   a. RF System Designer:
      1) Trained and certified in the use of RF design software such as iBwave.
      2) NICET IP-PCS Design certification or equivalent experience.
      3) Hold a valid FCC issued general radio operator's license.
   b. Lead Installer:
      1) Trained and certified by a nationally recognized organization, school or a certificate issued by the manufacturer of the equipment being installed.
      2) NICET IP-PCS Level III certification or equivalent experience.
      3) Hold a valid FCC issued general radio operator's license.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer instructions for storage and handling of coaxial cable to prevent damage to the cable.

1.9 WARRANTIES

A. Manufacturer Warranty: Manufacturer agrees to repair or replace specified product, and all of its components that fail in materials or workmanship within 12 months from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended use.

B. ERCES Active Components: Comply with UL 2524.

C. All equipment shall have required FCC approvals.

D. Enclosures: Provide NEMA 4 or 4X rated enclosures for all ERCES equipment per NFPA requirements. NEMA 3R rated enclosures may be used for battery systems that require venting. All enclosures shall be red in color.

2.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Delegated Design Criteria:

1. Coordinate with the AHJ to ascertain operating frequencies in use. Include local fire, police, EMS, Sheriff and any state, city or county first responder frequencies as required by the AHJ.
2. Provide equipment compatible with the existing state, county and local Fire/Police communications system utilized by the Public Safety and Emergency Responder agencies.
3. Fully coordinate with all agencies involved and any state, federal or county agencies required and fully comply with requirements of such agencies.
4. Provide a distributed antenna system to provide in-building amplification for all in-use bandwidths tuned to the frequencies utilized.
5. Comply with Frequency License Holder technical criteria.
6. Comply with applicable federal regulations outlined in FCC 47 CFR 90.
7. Provide a system that does not raise the noise floor at the public safety communications site closest to the ERCES or any other receiving site within the public safety communication network.
8. Provide a system that does not generate nor is susceptible to any harmful electromagnetic emission, radiation, or induction that degrades, obstructs, or interrupts the operation of the installed system, any computer system, or other building system.
9. Coverage: Provide a system that achieves sufficient signal coverage in 95 percent of all areas on each floor and 99 percent of all critical areas of the building.
10. Signal Strength: Provide a signal strength sufficient to produce usable voice communications throughout the coverage area as defined by the fire code official.
11. Maintain isolation between the donor antenna and all distribution antennas to a minimum of 20 dB above system gain.
12. Design and install the system per NFPA, Building Code, Fire Code, and FCC requirements.
13. Optional methods of achieving conformance to the code and distributing the signal throughout the building may be submitted for consideration.

2.3 MANUFACTURERS

A. 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. ADRF.
2. Bird Technologies.

3. Comba.
4. Commscope/Andrew.
5. Comprod.
6. Corning.
7. Dali.
8. Fractal Antenna Systems.
9. Laird Antenna.
10. Motorola.
11. Nextivity.
12. RFS.
13. Times Microwave.
14. Westell.

B. Source Limitations: Obtain components through one source who assumes responsibility for system component compatibility.

2.4 SYSTEM COMPONENTS

A. Bi-Directional Amplifier: Channelized Digital Single/Dual Band, Class A/B operation with frequency band(s) selected to match the local municipality public safety radio system(s).

1. Gain: Independently adjustable for both downlink and uplink amplification, selected to meet system performance criteria.
2. Provide BDA with the following features:
   a. Automatic Gain Control (AGC).
   b. Automatic Level Control (ALC).
   c. Oscillation detection and control circuitry.
   d. DSP Programmable RF filters.
   e. Firmware/software upgradeable band migration.
   f. Dry contacts for system monitoring.
   g. Wall mount enclosure.
3. Integral power supply with built-in battery charging.
   a. Primary power source: Hardwire to dedicated 120V, 20A branch circuit from lockable circuit breaker. Connect to emergency branch of standby generator where available.

B. Battery Backup Unit:

1. Secondary power source: Dedicated batteries and enclosure, capable of operating the system for at least 12 hours at 100% operation capacity.
2. Include self/automatic charging system.
3. Batteries: Marked with month and year of manufacture.

C. Remote Annunciator: Located in fire control room or other public location to annunciate to status of all signal booster locations.
1. Provide visual and optional audible annunciation of code required alarms.
2. Powered from Battery Backup Unit.
3. Low profile housing, wall mounted to standard electrical box.

D. Emergency Power Off Switch: Normally open switch suitable for manually turning on/off the amplifier via interface with BDA. Provide with guard to prevent inadvertent operation.

E. Antennas:

1. Donor Antenna: Type, frequency band, and azimuth pattern selected to meet system performance criteria.
    a. Donor Antenna Mast: Galvanized steel, wind rated per AASHTO Wind Charts with an additional 10 mph rating and a 1.3 gust factor. Include all required supports, mounting hardware, and anchoring required for components per manufacturer's requirements.
2. Distribution Antennas: Ceiling mount, low profile, with patterns selected to meet system performance criteria.

F. Passive RF Devices: Splitters, combiners, couplers, tappers, and attenuators.

1. Selected to meet system performance criteria.
2. Low insertion loss.
3. Connector Style: Compatible with system components.
4. Ingress Rating: IP65.

G. Cabling, Connectors, and Supports:

1. Select coaxial cable to support system frequencies and link budget.
2. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard, UL 444 or UL 1655, and NFPA 70 for the following types:
    a. Plenum Applications: Type CMP/CATVP complying with NFPA 262.
    b. Non-plenum applications: Type CMR/CATVR complying with UL 1666.
    c. Wet Location and Outdoor Applications: UV and moisture resistant OSP.
3. Backbone and Distribution Cable: 50-ohm, ½-inch low loss coaxial cable with copper clad aluminum inner conductor and continuous corrugated copper outer conductor.
4. Antenna Jumper Cable: 50-ohm, ½-inch super flexible pre-terminated coaxial cable assemblies.
5. Connectors: N-type or 4.3-10 mini DIN type threaded RF connectors.
6. Hangers and Straps: Designed and approved for use with associated cables.
7. Fiber Optic Cable and Connectors: Comply with Section 271300, "Communications Backbone Cabling"
8. Ensure any stop-bands built into the cable do not block the frequencies used.
9. Unless specified or approved by the Engineer, radiating coaxial cable is not permitted.

PART 3 - EXECUTION

3.1 PRELIMINARY RF COVERAGE ASSESSMENT

A. After the area of Work is permanently enclosed with all windows, doors, wall finishes, and roofing in place, perform an indoor and outdoor coverage assessment to determine if an ERCES is required.
   1. Utilize the grid testing methodology described in the Field Quality Control section to evaluate signal coverage in general and critical areas.

B. Submit results of assessment to Architect and Engineer for review.

3.2 PREPERATION

A. Before testing, verify and coordinate the following with the AHJ:
   1. Document all frequencies used by emergency responders within the jurisdiction.
   2. Document use of receiver base stations, repeaters or boosters in the first responder radio system, and if so, where they are located.
   3. Determine requirements for AHJ representation and involvement during testing. If representation is required either on-site or at receiver base station, costs involved shall be included in the Bid.
   4. Coordination with municipalities and the receiver base stations.
   5. Confirm if AHJ will waive radio coverage per building code and fire code exceptions.

B. Certificates and Authorizations
   1. Provide certificate of authority and/or operational authority from the frequency holder of all individual services utilizing this System. Include the FCC station identification information, details of frequency, power, and modulation, and a specific authority to operate a distribution and/or rebroadcast system on said frequency at the project location, any restrictions in operating conditions, levels, emissions or other conditions, and issued in the name of the facility with a point of contact at the Licensee.

3.3 EXAMINATION

A. Examine areas for compliance with manufacturer's installation requirements. Confirm installation tolerances and other conditions affecting performance.

B. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION

A. Wiring Methods: Install all cabling in accordance with manufacturer's recommendations. Conceal cabling, except in unfinished spaces.

1. Fire Resistance Ratings:

    a. Provide 2 hour rated enclosure or area for backbone cables and backbone cable components.
    b. Provide survivability level 1 or 2 for distribution cables per NFPA requirements.

2. Where backbone and distribution cable are subject to physical damage or where cabling is installed exposed in finished areas, provide raceway in accordance with Section 260533, "Raceways and Boxes for Electrical Systems" and Section 270528, "Pathways for Communications Systems".
3. Provide independent supports and secure cabling using approved hangers and straps at a maximum of 48-inches in accordance with Section 270528, "Pathways for Communications Systems".
4. Provide roof raceway penetrations for donor antenna cables with appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations to ensure compatibility with the roofing specifications and warranty.

B. Mount all active components on equipment racks or walls in readily accessible location acceptable to AHJ. Secure in place, plumb, square, and level. Mount wall mounted equipment over a 1/2-inch fire rated plywood, securely attached to the wall.

C. Provide a dedicated annunciator remote from the ERCES equipment at an approved location.

D. Antenna Installation:

1. Install antennas in accordance with manufacturer's instructions.
2. Donor Antenna:

    a. Locate antenna and mast to comply with system performance criteria.
    b. Affix antenna mast to rigid building structure, plumb and level, in a manner that does not invalidate roofing system warranty.
    c. Permanently affix donor antenna to mast using manufacturer's recommended hardware. Do not co-locate donor antenna with any other system antenna.
    d. Seal exposed donor antenna cable connections from moisture using butyl rubber wrap and UV resistant PVC tape.

3. Interior Distribution Antennas:

    a. Install interior antennas centered and in-line with other ceiling mounted devices.

E. Cable Installation:

1. Handle and install cabling without kinks, sharp bends or deformations or abrasions as recommended by the cable manufacturer to comply with bend radius requirements.
2. Comply with manufacturer's installation requirements for pulling and securing cable. Only utilize hangers and clamps approved for use with associated cable.
3. Utilize cable manufacturers stripping and crimping tools.
4. Properly support all cables with dedicated hangers or brackets.

F. Separation from other systems:

1. Install antennas and cabling a minimum of 24" from any EMI producing source. Coordinate routing with field conditions and other trades.

G. Fire Alarm Monitoring:

1. Provide interface with fire alarm system to monitor signal source and system integrity in accordance with Fire Code, NFPA 1225, NFPA 72 and Section 284613, "Addressable Fire Alarm Systems".
2. Report system malfunctions as supervisory signals in accordance with NFPA requirements.
3. Where approved by the building code official, a single supervisory interface may be used.

H. Survey facility for any other RF producing components such as mobile radio or base stations and maintain proper separation of antennas to not cause interference. Perform adjustments to power output or antenna locations as required to mitigate interference. Coordinate any required system adjustments with Owner's representative.

I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

J. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

3.5 GROUNDING AND BONDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" and Section 270526 "Grounding and Bonding for Communications Systems".

1. Ground cable shields and equipment per manufacturer's requirements.
2. Provide antenna discharge units and surge protection for donor antenna coaxial cabling in accordance with NEC requirements. Locate as close to building penetration as possible.
3. Ground antenna, antenna mast, and discharge units in accordance with NEC and manufacturer's requirements.

3.6 IDENTIFICATION

A. Comply with requirements in Section 260553 “Identification for Electrical Systems”.

1. Identify all interior antennas to coincide with schematic diagram inside BDA.
2. Identify all exterior RF Antenna cables outside and inside at their point of entry.
3. Identify all cabling at regular intervals but not less than 50ft with identifiers reading “Public Safety Radio”.
4. Permanently affix schematics of the system within the main BDA enclosure.
5. Affix FCC information as to the license holder, call letters, frequencies in use and other pertinent information on the exterior of the BDA along with the system integrator contact information.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

B. Provide written 7-day advance notice of any testing to allow The Engineer and Owner’s Representative the option to witness the tests.

C. Visual and Mechanical Inspections:

1. Inspect connectors for correct pin depth, torque, and weatherproofing.
2. Inspect cables for damage from inadequate bending radius, crushing, or deformation.
3. Verify mechanical protection has been provided where cables are subject to physical damage.
4. Confirm labels for donor antenna(s) physical location(s), cable type and cable length.
5. Ensure all cables are securely captivated with an approved clamp or strap and that the outer jacket has not been compromised from over tightening.
6. Verify all interior antennas have an identifying number visible from the traffic path location.
7. Verify equipment enclosure ratings and check for proper ventilation.
8. Verify that the antenna(s), BDA(s), and applicable power supplies are installed to standards and are provided with appropriate working clearances.

D. System Startup Testing:

1. Confirm proper donor antenna orientation via signal strength test. Coordinate with system municipality for the closest and/or strongest tower/signal source to determine orientation.
2. Sweep donor antenna(s) using a calibrated FTDR for Return Loss and Distance to Fault.
3. Measure and record donor antenna grounding hardware and ground resistance for adherence to manufacturer or R56 specifications utilizing a megger documenting reading(s) and exact location(s).
4. Measure and record received signal strength of all applicable frequencies at input.
5. Verify BDA amplified power output with spectrum analyzer in both directions from RF in/out.

6. Test amplifiers for proper gain output and signal level.
7. Check spectral purity of amplified signal for harmonics, spurs and distortion in both directions.
8. Perform an over the air sweep test for excessive harmonic content, spurs and distortion.
9. Sweep entire cable plant of each frequency band utilizing a FTDR for Return Loss and Distance to Fault from BDA out to building.
10. Cabling and connectors shall be tested with a FTDR Meter for continuity and signal levels for RF power. Testing shall be for input and output paths.
11. Check and log AC input voltages and document circuit number, breaker and physical location for both the BDA and AC/DC supply.
12. Test battery output under load for 1 hour for proper output. Test charging circuitry for proper performance.

E. Acceptance Tests

1. Utilize a grid testing procedure to test all the radio frequencies used by the ER for sufficient coverage, signal quality, and signal strength.
   a. Divide each floor area into a grid of 20 equal test areas.
   b. Test each grid area for signal quality and signal strength using test methods described below.
   c. Perform measurements starting in the center of each test grid. Moving in a pre-defined “X” pattern, obtain sample values to create a statistical average for the test area.
   d. Repeat testing methodology for each grid area.
2. RF Signal Strength Testing
   a. The signal strength test shall be conducted using a calibrated (within last 12 months) spectrum analyzer utilizing antennas similar to those used by the emergency responders.
   b. Where signal strength out of the building cannot be efficiently measured, a DAQ Test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency’s radio communications system.
   c. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.
   d. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency’s radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered failure of that test area. Additional test locations shall not be permitted.
   e. Measurements shall be made with the antenna held in a vertical position at three (3) to four (4) feet above the floor to simulate portable radios worn on the belt or turnout coat pocket.
   f. A maximum of one (1) (or 5 percent) of nonadjacent test areas shall be allowed to fail the test per floor.
   g. In the event that two or more (or > 5 percent) of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of more than two (or 5 percent)

nonadjacent test areas shall result in failure of the test. If the building fails the 40 area test, the building shall be deemed in non-conformance to Code. The facility shall be equipped with an in-building RF amplification antenna system to meet a 90 percent coverage requirement per floor and retested.

h. The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file with the building Owner so that the measurements can be verified during annual tests.

3. Voice Signal Quality Testing
   a. For quality purposes, DAQ readings shall be taken at the same time as the above RF signal strength measurements. The DAQ scale is as follows:
      1) DAQ 1: Unusable. Speech present but not understandable.
      2) DAQ 2: Speech understandable with considerable effort. Requires frequent repetition due to noise or distortion.
      3) DAQ 3: Speech understandable with slight effort. Requires occasional repetition due to noise or distortion.
      4) DAQ 3.4: Speech understandable without repetition. Some noise or distortion present.
      5) DAQ 4: Speech easily understandable; little noise or distortion.
      6) DAQ 4.5: Speech easily understandable; rare noise or distortion.
      7) DAQ 5: Perfect; no distortion or noise discernible
   b. A DAQ level of 3 or better throughout the building shall be deemed acceptable and passing. Areas not achieving this level shall be deemed as failing.
4. Test Fire Alarm Supervisory Signals in accordance with NFPA 72 and project fire alarm specifications. Verify proper annunciation.

F. Test and Inspection Reports: Prepare a written report to certify compliance with test parameters and record the following:

1. Test procedures used.
2. Date, time, and weather conditions during testing.
3. Results that comply with requirements.
4. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
5. Prepare information in a format required by the AHJ.

G. Products will be considered defective if they do not pass tests and inspections. Remove and replace malfunctioning units and retest as specified above.

H. Permission to operate any ERCES system should be provided in writing.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Completion, provide on-site assistance in adjusting antennas to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.9 DEMONSTRATION

A. Provide 4 hours of system training and maintenance instruction to Owner's personnel.

END OF SECTION 27 53 19

SECTION 28 10 00 – ACCESS CONTROL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. This specification details the supply, installation, and commissioning of a complete Integrated Security Management System (ISMS). The system shall follow local and international codes, standards, and meet the technical and performance criteria in this document.

B. The system is to be supplied with all equipment, hardware, software, cabling, and ancillary devices as required to provide an ISMS complete and functional in all respects. The bidders are to familiarize themselves with all matters related to the requirements and to account for such in the price as part of their proposal response.

C. All security system components not specifically included in this specification shall be fully integrated with this ISMS.

D. It is the responsibility of the bidder to obtain clarification of all matters in which doubt exists as to the exact intent of this document or in which a conflict appears to have arisen. Such information must be obtained prior to the closing and lodging of bids in accordance with the Request for Information (RFI) procedures outlined in the general terms section of the specification document.

E. The response shall clearly state all pricing for components, cabling, installation, engineering, training, startup, commissioning, and include a minimum 5-year comprehensive advance replacement warranty. The warranty period shall commence when the owner achieves beneficial use.

1.02 REFERENCES

A. Terminology and Abbreviations

1. ACS: Access Control System
2. ADRC: Advanced Dual Reader Controller
3. AES: Advanced Encryption Standard
4. AMT: Alarm Management Terminal
5. API: Application Programming Interface
6. BLE: Bluetooth Low Energy
7. CAK: Card Authentication Key
8. CSN: Card Serial Number
9. DAS: Direct Attached Storage
10. DHCP: Dynamic Host Configuration Protocol
11. DPS: Door Position Sensor

12. DRI: Dual Reader Interface
13. ECC: Elliptic Curve Cryptography
14. FASC: Federal Agency Smart Credential
15. FASC-N: Federal Agency Smart Credential Number
16. FICAM: Federal Identity, Credential, and Access Management
17. FIDO: Fast Identity Online
18. FIPS: Federal Information Processing Standard
19. GUID: Global Unique Identifier
20. HBUS: Intelligent High-Speed Encrypted Communications Protocol over RS485
21. IDS: Intrusion Detection System
22. IFC: Intelligent Field Controller
23. IICM: Intelligent Input Control Module
24. IIOM: Intelligent Input / Output Module
25. IRM: Intelligent Reader Module
26. ISMS: Intelligent Security Management System
27. IP: Internet Protocol
16. ISO: International Organization for Standardization
17. LAN: Local Area Network
18. LDAP: Lightweight Directory Access Protocol
19. MPF: Monitored Pulse Fence
20. NAS: Network Attached Storage
21. NFC: Near Field Communications
22. NVR: Network Video Recorder
23. OCM: Output Control Module
24. ODBC: Open Database Connectivity
25. OPC: Object Linking and Embedding (OLE) for Process Control
26. OPC AE: OPC Alarms and Events
27. OPC DA: OPC Data AccessOSDP: Open Supervised Device Protocol
28. PACS: Physical Access Control System
29. PIDS: Perimeter Intrusion Detection System
30. PIV: Personal Identity Verification

31. POE: Power-Over-Ethernet
32. RAM: Random Access Memory
33. REST: Representational State Transfer
34. REX: Request to Exit
35. RFID: Radio Frequency Identification
36. SAN: Storage Area Network
37. SIA: Security Industry Association
38. SMS: Security Management System see ISMS
39. SQL: Structured Query Language
40. SSL: Secure Sockets Layer
41. TCP: Transport Control Protocol
42. TWIC: Transportation Worker Identity Card
43. UPS: Uninterruptible Power Supply
44. VMS: Video Management System
45. WPF: Windows Presentation Foundation
46. XML: Extensible Markup Language

B. Reference Standards & Trademarks
   1. Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)
   2. Federal Communications Commission (FCC), Code of Federal Regulators, Part 15, Subpart B, Radio Frequency Devices, Unintentional Radiators
   3. Institute of Electronic and Electrical Engineers (IEEE) 802.3 Ethernet standards
   4. Underwriters Laboratories (UL)
      a. UL294 - The Standard of Safety for Access Control System Units
      b. UL2610 - Proprietary Burglar Alarm Units and Systems (supersedes UL1076)
      c. UL2050 – National Industrial Security System Capable
   5. Underwriters Laboratories of Canada (ULC)
      a. ULC-ORD-C1076 – Burglar Alarms
   6. Canadian Standards Association (CSA)
      a. C22.2 205 Access Control
   7. ISO/IEC 14443-3:2011 – Identification Cards

8. Federal Information Processing Standard Publication 140-2 – Security Requirements for Cryptographic Modules with Level 3 validation
9. Federal Information Processing Standard Publication 197 – Advanced Encryption Standard
10. Federal Information Processing Standard Publication 201-2– Personal Identity Verification, 13.01 and 13.02 Topology
11. SP 800-116 A Recommendation for the Use of PIV Credentials
12. IEC 60839-11-5:2020 - Open Supervised Device Protocol (OSDP)
13. UK CAPSS Certification – Cyber Assurance of Physical Security Systems 2021 1.1
14. CPA-Build Standard – UK National Cyber Security Centre
15. BS-EN50131
16. BS-EN60839-11-1
17. IEC 60839-11-1
18. AS/NZ 60839-11-1
19. AS/NZ 2201 Class 5
20. Apple, Apple Wallet are trademarks of Apple Inc., registered in the U.S. and other countries and regions.

1.03 SUBMITTALS

A. Product Data
   1. Manufacturer’s printed or electronic data sheets
   2. Manufacturer’s installation and operation manuals
   3. Warranty Documentation
B. Maintenance Materials
   1. Spare parts schedule: Type and quantity of recommended spare parts
C. Shop Drawings and Schematics
   1. Depict the system in a final “as built” configuration, including equipment locations, sub-system interconnections and cabling details.

1.04 QUALIFICATIONS

A. Manufacturer of system shall have a minimum of ten years’ experience of successful manufacture and installation of systems equivalent in scope and function to the system(s) proposed herein.
B. Manufacturer of system shall deploy infrastructure to generate, process and store cryptographic keys and certificates to prevent Supply Chain attacks.

C. Installation contractor shall be certified to install service and maintain the system by the system manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver the equipment in the manufacturer's original, unopened, undamaged container with identification labels intact.

B. Store equipment within temperature and humidity ranges specified by the manufacturer.

1.06 WARRANTY & SUPPORT

A. Hardware warranties shall be provided by the original manufacturer of the specific hardware device or component for a minimum period of 5 years, including advanced replacement.

B. Manufacturer shall offer a supplemental software support program to include software updates and upgrades, which, if exercised, extends the hardware warranty up to 10 years, including advanced replacement.

C. Hardware warranty for non-display credential readers shall be a lifetime warranty, including advanced replacement.

D. Manufacturer shall provide global 24x7x365 factory technical support.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. The following manufacturers are approved to submit proposals for this project:

1. Basis of Design: Gallagher Security
2. Alternate Manufacturers: Genetec Security Systems, Avigilon Access Control
3. Additional manufacturers meeting the above qualifications and system performance/intent shall be permitted to submit proposed systems for this project. Proposed systems shall be reviewed by the design team and the owner for acceptance. Proposed systems shall be submitted with qualification data, proposed system architecture, and reference information for review/acceptance.

   Final acceptance of alternates shall be at the discretion of the engineer of record and the owner.

2.02 GENERAL DESCRIPTION

A. The ISMS shall be the primary system for the management of the physical security system outlined in this specification document.

B. The ISMS / ISMS manufacturer and ISMS hardware shall be approved for the

following applicable certifications, attestations and or standards:

1. ISO 27001:2022
2. SOC2 Type II
3. ISO 9001:2008 or later
4. DCID 6/9 ICD 705 (full compliance)
5. FIPS 201-3 Approvals 13.01 and 13.02 Topology
6. NIST FPIS199, SP800-53
7. FIPS 140-3
8. FISMA / NIST RMF
9. UL 294
10. UL 2050 Capable
11. UL 2610
12. Section 889 Compliant
13. NDAA Compliant
14. TAA (Federal) Compliant
15. CE approval BS EN 50130-4 Alarm Systems Electromagnetic Compatibility (Immunity)
16. CE approval BS EN 55022 Emissions
17. ULC -60839
18. ULC-S304
19. ULC-C1076
20. FCC Part 15
21. UK CAPSS - UK National Cyber Protective Authority
22. CPA-Build - UK National Cyber Security Centre / GCHQ

C. Additionally, ISMS Encoders and readers shall meet the following standards:

1. CE ETS 300 683 Short-Range Devices
2. C-Tick AS/NZS 4251 Generic Emission Standard
3. C-Tick RFS29

D. The ISMS shall allow for multi-site configuration and allow for management by one or more of the connected sites utilizing Microsoft SQL Server as the database

management system.

E. The ISMS shall include in the core product code (but not limited to) the following:
   1. access control
   2. Intrusion / alarm management
   3. personnel / identification / credential management
   4. visitor management
   5. guard tour management
   6. perimeter intrusion deterrence and detection
   7. facility/compliance management
   8. 3rd party integrations via:
      a. RESTful API
      b. OPC
      c. BACnet
      d. Active Directory
      e. Entra ID (previously – Azure AD)
      f. SIP
      g. WebOS (delimited file import/export)
      h. LDAP / LDAP2
      i. ODBC
      j. XML

F. The ISMS shall provide a means to control access through selected doors/openings having electric locking status monitoring and credential based control reader. Access rights associated with a presented access token shall be checked for validity based on token or identifier, access area, access time and any other access management function defined in this specification. All validity criteria shall be stored at the Intelligent Field Controller (IFC). Access shall be granted or denied, dependent on the credential holder's access privilege. Access privileges shall be programmed in a variety of ways to allow flexibility as defined elsewhere in this specification. The access control ISMS component shall be intrinsically integrated with the intrusion alarm aspects of the system allowing for cohesive or independent deployment.

G. The ISMS shall provide a fully functional intrusion alarm system, including entry and exit delays where intrusion detection sensors are connected to system inputs which are components of the Intelligent Field Controller (IFC) architecture. It shall be

possible to arm/disarm areas from any access control reader associated with an area, access control reader with keypad, Alarm Management Terminal (AMT), or as required from defined central control locations The intrusion alarm ISMS component shall be intrinsically integrated with the access control aspects of the system, allowing for cohesive or independent deployment.

H. The ISMS shall provide a built-in software module for the design and production of photo ID cards.

I. Connection between ISMS servers and IFCs shall be achieved using physical medium supporting the TCP/IP protocol. The network connection must be on board the IFC. Interface transceiver units (Ethernet to RS485, RS232, etc.) are not acceptable.

J. The ISMS shall support IPV4 / IPv6 for all TCP/IP network connections.

K. Remote IFCs not permanently connected to the network can be connected via WAN connection.

L. IFCs must support peer-to-peer communications between IFCs. Systems that require a permanent server connection for communications between IFCs are unacceptable.

M. All data communication between the ISMS and IFCs shall use an industry-standard encryption algorithm for mutual authentication and session key negotiation. This algorithm shall be equivalent to ECC P-384 or stronger. Session keys shall be re-negotiated on a regular basis at intervals no longer than 30 hours. All data communication between the ISMS and IFCs shall be encrypted using an industry-standard encryption algorithm equivalent to AES-256 or stronger.

N. All data communication between IFCs shall use an industry-standard encryption algorithm for mutual authentication and session key negotiation. This algorithm shall be equivalent to ECC P-384 or stronger. Session keys shall be re-negotiated on a regular basis at intervals no longer than 30 hours. All data communication between IFCs shall be encrypted using an industry-standard encryption algorithm equivalent to AES-256 or stronger.

O. All data communication between IFCs and intelligent edge devices such as readers and I/O devices shall use an industry-standard encryption algorithm for mutual authentication and session key negotiation. This algorithm shall be equivalent to ECC P-256 or stronger. Session keys shall be re-negotiated on a regular basis at intervals no longer than 30 hours. All data communication between IFCs and intelligent edge devices such as readers and I/O modules shall be encrypted using an industry-standard encryption algorithm equivalent to AES-128 or stronger.

P. All inputs to field I/O must support multi-state monitoring with the ability to select the resistance values of the state changes.

Q. The ISMS shall report all events to the operator(s) (based upon defined privileges) as configured and shall produce and maintain a log of all system events, alarms, and operator actions.

R. The ISMS shall provide a means for an operator to extract information relative to the

event log and system configuration and produce this information in the form of printed reports, emailed reports, screen displays, or exported files directly from the ISMS itself.

S. The ISMS shall provide a GUI with user configurable site plans and interactive icons representing the location and real-time status of all monitored hardware within the ISMS.

T. The ISMS shall provide emergency evacuation reporting.

U. The ISMS software shall be written in a fully structured, fully validated, and commercially available language within a strictly controlled development environment.

V. Comprehensive backup and archiving feature shall be incorporated as an integral part of the ISMS.

W. The ISMS shall include partitioning (example: multi-tenant buildings). Users shall only be able to access those parts of the system which fall within their assigned partition.

2.03 SYSTEM REQUIREMENTS

A. SCALEABILITY

1. The ISMS as described in this document must have the following capacity at a minimum:

a.	Configured clients (thick & thin inclusive)	Unlimited
b.	Graphical site plans	Unlimited
c.	Access Control readers	Unlimited
d.	Elevators floors each	1000 elevators of 256
e.	Fully supervised 6 state inputs	Unlimited
f.	Output relays	Unlimited
g.	Access control zones	Unlimited
h.	Schedules per day	100
i.	Schedule categories	50
j.	Day Categories	400
k.	Operators	Unlimited
l.	Concurrent operator sessions	160

m. Cardholders Unlimited

n. Cardholder issue levels 15

o. Cardholder custom data fields >1000

p. Intelligent Field Controllers 10000 per server

2. The system architecture shall be a tiered system consisting of:

   a. one installation of the system application operating on a primary server with the option for “headless” operation

   b. operator workstations as clients of the application installed on the server.

   c. IFCs interconnected via peer-to-peer communications, managing the IFCs in a distributed intelligence format.

   d. semi-intelligent, uniquely identified, and encrypted sub-units (Input/Output modules, Readers, etc.) that are dependent on IFCs to function.

B. SYSTEM SERVERS AND WORKSTATIONS

1. The server shall use a Microsoft Windows (64 bit) operating system. Server operating systems such as Linux, Unix, and OSX are not acceptable.

2. The operating system used by the system server shall be Microsoft Windows Server (see manufacturer’s documentation for current supported versions).

3. The operating system used by the workstations shall be Microsoft Windows Pro/Enterprise (64 bit) (see manufacturer’s documentation for current supported versions).

4. The database engine used by the system shall be one of the following (see manufacturer’s documentation for current supported versions):

   a. Microsoft SQL Server (64 bit)

   b. Microsoft SQL Server Express (64 bit)

5. Workstations shall support multi-monitor operation.

6. Workstation display resolution shall be a minimum of 1920 x 1080 pixels.

C. CENTRALIZED SYSTEM MANAGEMENT SOFTWARE AND HARDWARE

1. The ISMS servers shall use a Microsoft Windows operating system and version of SQL as defined previously based upon manufacturers’ recommendations as it relates to configuration and system size.

2. The connection between ISMS and Microsoft SQL Server shall use Windows Authentication or Active Directory.

3. The ISMS server shall incorporate current generation architecture and components. The hardware specification, including processor speed, internal memory and hard disk size shall be specified by the ISMS manufacturer and must be sufficient to meet or exceed the capacity and throughput of the specified system.
4. The ISMS server shall be available for deployment using Microsoft Server in the following configurations in accordance with the ISMS manufacturer's recommended specifications:
    a. On premise
    b. On private cloud
    c. On public cloud
5. The ISMS shall be capable of supporting connections with a minimum of 120 hardware-based (thick client) operator workstations running concurrently. Operator workstations running terminal emulation software will not be accepted.
6. The ISMS shall automatically log and time/date-stamp all events within the system including intrusion alarm arm/disarm events, access control events, operator actions and activity.
7. The configuration GUI shall make extensive use of menus and graphical interfaces and require a minimum of operator training to operate the system proficiently. Systems requiring a script/program language approach to configure the system will not be accepted.
8. A free text notes/memo field that supports word-wrap, insert, delete, cut, copy and paste text editing functions shall be available for each logical/physical object to store information relating to that item and support 128,000 characters of text.
9. The ISMS must be capable of receiving simultaneous alarm signals from all system locations without loss or excessive delay in their presentation to the operator. Any authorized operator will be allowed to acknowledge, view, annotate, and/or process an alarm depending on their permission level.
10. The ISMS server shall incorporate a real-time clock, the accuracy of which shall be preserved in the event of a power supply failure. Time synchronization between the ISMS and Ethernet-connected IFCs shall be automatic and not require operator intervention.
11. Operator selection of processing tasks shall be via menu selections. Authorized operators shall be able to process alarms, produce reports, and modify items without degrading system performance.
12. The following is the minimum operational and monitoring functions required. The ability to:
    a. program either a group or individual card readers with access control parameters, without affecting other card readers.
    b. program the access criteria for individual cardholders or groups of

cardholders

c. store non-access control data fields for each cardholder. The names of these data fields shall be user-definable.

d. authorize or de-authorize a cardholder in the system with the result reflected immediately throughout all access points in the system.

e. enable a card trace against selected cardholders so that an alarm is raised each time that cardholder presents their access card or token.

f. pre-program holidays so that different access criteria apply compared to normal scheduled days. The system must have a capacity to arm at least 400 holiday days.

g. recognize and manage multi-regional holiday requirements.

h. define access zones.

i. permit or deny individual cardholder access to any single, or group of card readers, in real-time.

j. log all ISMS and operator activity to storage as it is received at the ISMS server.

k. program alarm response instructions into the system so that these are presented to the operator when viewing, acknowledging, or processing an alarm event.

l. enable an operator to enter messages against alarm events. This may be an enforced operator operation based on configuration on a per-operator basis.

m. configure user-definable short messages to allow the operator to enter commonly used comments with minimal effort when entering messages related to alarms. For example, false alarm, user error, etc. These messages should also be assigned to keyboard shortcut keys to enable faster commenting on alarms.

n. temporarily override a cardholder, or group of cardholders, pre- programmed access criteria.

o. update multiple Alarm Management Terminals (AMTs) display messages quickly using the bulk change feature.

p. create custom non-cardholder field types as a String, String List or Boolean

13. The operator GUI shall display a one-line plain language event message for every activity event (alarm or otherwise) occurring in the system. All activity logged shall be time and date stamped to the nearest second (hh:mm:ss). On having the appropriate operator authorization, it shall be possible to drill down into the properties of each component that makes up that event. The event message shall advise:

    a. the time of the event created at the IFC

    b. the time the event was received at the ISMS server

c. the source of the event

d. any successful or unsuccessful access attempt

e. if the access attempt is unsuccessful, the reasons for the denial

14. This includes but is not restricted to the following items:

    a. all card attempts

    b. all door alarms

    c. all operator activity including logon, logoff, and alarm response messages

    d. all alarm monitoring activations

    e. all communication link failures

15. Time schedules for different days shall be configurable.

16. Regional holidays shall be configurable to allow for regional variations.

17. The system shall provide a detailed operator help file. This help file shall provide operators with text, audio, and video, help instructions and tutorials.

18. The system shall allow for searching of items configured within the system based on the following:

    a. item characteristics

    b. related items

    c. times related to events including within properties of a configured item (creation and modification events)..

19. The system shall integrate with Microsoft Active Directory enabling cardholder and user records to be fully synchronized on a real-time, bi-directional basis.

20. Integrations that use third party applications to synchronize between Microsoft Active Directory and the system shall not be acceptable.

21. The system shall be able to find unmigrated and duplicate DesFire credentials.

22. ISMS shall be able to purge pending queued messages from IFCs as required by the user with this privilege.

23. ISMS shall be able to deploy IFC firmware as follows via an upgrade feature:

    a. On Demand

    b. On a predetermined schedule

24. ISMS shall allow the user to track IFC firmware deployment status via the upgrade feature.

25. ISMS shall allow users to securely connect via a web-based client without the need for the user to utilize a separate client-based application and provide the following functionality:

a. View cardholder's history and activities

b. Manage cards (excluding printing and encoding) and credentials

c. Manage cardholders and assign access

26. ISMS shall allow bulk configuration and setup of supported system devices via a delimited CSV file.

27. ISMS shall allow for configuration and setup of a read-only replica SQL database in a highly available environment to preserve and reduce load on the primary SQL database.

28. ISMS shall support the redaction of the following Personal Identifiable information to meet GDPR requirements:

    a. Cardholder Events

    b. Cardholder Information

29. System software installation shall support command-line silent installation

30. ISMS shall support cardholder case and accent sensitive searches.

D. COMMUNICATIONS AND DIAGNOSTICS

1. The ISMS shall automatically restart full and complete processing after recovery due to a power outage

2. The ISMS shall provide a full diagnostic log to enable technical personnel to monitor system operations in the event of a system malfunction.

3. The diagnostic log shall be stored in a separate file on hard disk from all other data files.

4. ISMS diagnostic logs must be available without shutting down or pausing the ISMS.

5. The ISMS shall provide system diagnostic features which enable authorized operators or systems engineers to monitor and then tune the system performance (communications network performance tuning, for example).

6. ISMS shall be able to send the IFC its IP address.

7. ISMS shall be able to accept requests from anywhere on its server IP address and connect these requests securely and easily to REST APIs hosted on an on-premises system using a WebSocket tunnel between the ISMS and the API gateway.

8. API gateway shall have multiple redundant services internally allowing for zero-downtime upgrades, hardware and software fault tolerance, and scalability.

9. API gateway shall use TLS client certificates for Rest API requests.
10. ISMS real-time diagnostic data feeds shall poll various sources including Windows OS performance monitor.

E. CYBERSECURITY

1. The ISMS manufacturer shall supply documentation detailing the cryptography used in the supplied products including:
   a. included digital certificates
   b. database encryption
   c. server to workstation connections
   d. server to IFC connections
   e. data at rest on IFC
2. The ISMS manufacturer must provide proof of independent penetration testing for the release of software to be installed.
3. Vulnerabilities found in the ISMS software must be notified to customers via a CVE Entry for a minimum of two years after software release.
4. The ISMS manufacturer shall supply a software tool external to the ISMS server to test the installed server for vulnerabilities.
5. The system Simple Mail Transfer Protocol (SMTP) library shall support Microsoft office 365.
6. The system shall support a SQL Database monitor service which logs SQL Database login attempts.
7. Login into the ISMS from the web-based client is secured with 2-factor authentication
8. The web-based client shall not store any sensitive data, data remains hosted on the primary ISMS server.

F. MULTIPLE SERVER CONNECTIVITY

1. ISMS based on multiple servers shall be supported.
2. Each server shall communicate directly with its local IFCs.
3. Operators shall be able to centrally control access at a remote location in a multi-server environment
4. Should a network failure occur between servers, each server shall continue to communicate with their local IFCs.
5. Should a network failure occur between servers, operators shall be able to

continue to manage the local system connected to their respective servers. This includes (but is not limited to) the following functions:

a. manage alarms

b. override and manage doors

c. arm and disarm alarms

d. edit cardholders

e. run reports

6. Alarms and events from all servers shall be able to be displayed on any or all of the system workstations.
7. The cardholder database shall be automatically replicated to all servers as a global entity.
8. Replication of cardholder changes shall occur as changes are made and not batch processed.
9. Communication between servers shall be peer to peer.
10. The multiple server environment shall allow for evacuation reports for each site on the multiple server system to be generated on one server, for one or more remote servers.
11. Operator GUI views and program access privileges shall follow the same rules across multiple servers as apply within a single server.
12. ISMS items configured on existing servers shall automatically be recognized by any servers added to the multiple server group. Likewise, ISMS items configured on the server(s) being added shall be automatically recognized by the existing multiple server group.
13. Use of software interface custom written modules or scripts to connect servers into a multiple server configuration shall not be permitted.
14. Manual or script re-entry of data for existing servers into any new servers being added to the multiple server group shall not be permitted.
15. Synchronization of data across all servers shall be an automatic real-time function not requiring operator intervention or initializing.
16. Should communication be lost between two or more servers, the individual servers shall continue to function independently and shall resynchronize all changes made whilst off-line automatically after reconnection to peer servers.
17. Should a conflict occur resulting from two items being created in two or more servers whilst servers are off-line then an alarm shall be raised when the

servers are re-joined advising of the conflict.

18. Should an existing record be modified in two or more servers whilst the servers are off-line then on reconnection, the modifications shall be carried out in time order of the modifications.

19. There must be a native tool within the operator GUI to remove redundant servers from a multiple server configuration. The use of scripts or external applications is not allowed.

G. GRAPHICAL OPERATOR INTERFACE

1. Configuration or operation using scripting or other forms of text-based programming will not be accepted.

2. There shall be a user configurable view, designed specifically for the task and the information needs of the operator.

3. Default operator views shall be provided covering the primary site management functions of:

   a. events

   b. alarm management

   c. cardholder management

   d. access management

   e. site monitoring

calendars and scheduling

   f. macros

   g. operator management

   h. mobile device management

   i. site wide system changes

   j. reports

4. The ISMS shall allow the creation of customized views to enable operators to access information relevant to a specific business workflow within one screen.

5. The operator GUI shall be fully configurable by an operator with authorization to configure the GUI.

6. The operator GUI may be dynamically separated into multiple windows to allow for multi-monitor operation, closing the secondary GUI will automatically return navigation items to the primary GUI.

7. The primary operator GUI will always display an alarm count differentiated by

alarm priority.

8. Each view shall consist of a navigation menu area and a dynamic viewing area as detailed below:
    a. The navigation area shall provide a list of relevant data related to a specific workflow as defined by the task at hand.
    b. It shall be possible to select and order the columns of data in the navigation area associated with alarm and cardholder views.
    c. Dynamically updated search results shall be provided when typing into the search field for a cardholder view.
    d. Selection of a line item in the navigation area shall cause the associated dynamic information viewing area to be populated with data relevant to the selected item.
    e. Within the dynamic viewing area one or more data tiles shall be provided to display detailed data associated with the navigation area item selected.
    f. Data tiles shall be able to be created based on a range of default tiles provided for this purpose.
    g. Each data tile shall be configurable with the required data fields as determined by the function of the tile.
    h. Data tiles shall be maximized to enlarge the display area for that data by single click operation. Another single click operation on this tile will return all tiles to original size and location.
    i. When a data tile has been maximized, other tiles shall remain visible in thumbnail format, allowing a single click to make them the selected maximized data tile.
    j. Where applicable, minimized tile icons shall display dynamic content.
    k. There shall be provision for displaying data tiles within the dynamic viewing area that link to external sources.
    l. The linked data tile shall allow either a URL address, PDF, or TXT file to be selected.
9. Navigation from a URL shall be configured either as:
    a. navigation enabled
    b. restricted navigation allowing navigation to hyperlinks on the site but not to enter a URL,
    c. navigation disabled

10. Auto refresh of a URL shall be configurable down to 1-minute interval
11. An event view shall be available with the following capabilities:
    a. allow the operator to view events in real-time
    b. the displayed data columns shall be configurable
    c. the columns shall be sortable
    d. auto scroll capability
12. The event view shall also allow the operator to search for and select historic events, even when they have been cleared from the real-time view window. This shall include:
    a. search based on time/date
    b. search based on the source of the event
    c. the selected historic event shall appear in the event window with the same relevant data as if it were a real-time event
    d. display a count of the number of events which were found
13. When a single event has been selected the following information shall be possible to be displayed:
    a. instructions for the operator
    b. details of the event
    c. site plan
    d. cardholder image (where appropriate to the event)
    e. video camera feed (where appropriate to the event)
    f. recent event history for the door (where appropriate to the event)
    g. recent event history for the cardholder (where appropriate to the event)
14. The system shall support Microsoft Edge as the default browser if WebView 2 Runtime is installed on workstations.
15. Calls from supported intercoms shall be managed from a central location within the GUI using a unified intercom viewer.

H. SYSTEM OPERATOR MANAGEMENT

1. Operator establishment and maintenance shall be a restricted privilege.
2. It shall be possible to define specific ISMS privileges for a group of operators and an individual operator can be added or removed to this group without

changing any other properties of that group or the operator than this relationship.

3. Operator access to the operator GUI is to be restricted by means of a unique operator identifier and password.
4. It shall be possible to apply password restrictions that consist of (but are not limited to) the following:
    a. minimum password length
    b. mixed case
    c. mixed alpha and numeric characters
    d. mandatory change of password after a defined period
    e. remembering and rejecting at least 999 previously used passwords
5. There shall be default password restrictions that cannot be disabled as follows:
    a. Passwords must not contain the login name, first name, or last name of the operator
    b. There shall be a file containing common passwords that will not be allowed, this file will be editable by the customer to strengthen or relax the disallowed passwords
6. The system shall support an Active Directory Single Sign-On feature to allow access to the operator GUI without password if they are already logged into an authenticated Windows session.
7. Each operator shall have the authority to alter their own password.
8. Automatic logoff may occur after a pre-defined time of up to a maximum of 1440 minutes of operator inactivity.
9. It shall be possible to configure the system to only allow one simultaneous logon per operator.
10. It must be possible to allow or deny operators access to various menu functions.
11. It shall be possible to view groups of system objects for individual operators where (example); operator for building 1 can see and act on building 1 alarms and view (only) building 2 alarms with the inverse for operator 2 for building 2.
12. Any menu option not available to an operator should be either greyed out or not visible.
13. It shall be possible for a suitably authorized operator to view connected data

sessions on the ISMS, and the following minimum information shall be displayed:

a. device name

b. login credential

c. session type, i.e. operator GUI, mobile application, data connection OPC/XML etc.

d. session status

e. it shall be possible for a suitably authorized operator to terminate any data session

I. RESTful API

1. The ISMS shall support a RESTful web API .
2. The RESTful API shall support client certificate pinning for connection security.
3. The RESTful API shall be authenticated and secured using TLS client certificates (2048- bit RSA).
4. The RESTful API shall support HTTPS for data transfer.
5. RESTful API should allow Cardholder data Synchronization between ISMS servers
6. RESTful API shall interface to the Visitor Management component of the ISMS in order to achieve the following functions:
   a. Create Visitor
   b. Modify any Visit attributes
   c. Delete Visitor
7. ISMS shall allow RESTful API to create, amend and delete access schedules as a requirement for an SSOT architecture.
8. RESTful API shall allow for mixed key-and-certificate authentication.
9. RESTful APIs are utilized for Active Directory Cardholder Synchronization.
10. The system shall support Events and Cardholder data Synchronization from a source to destination servers by utilizing RESTful APIs.
11. The web-based client shall use RESTful API via an API Gateway that has no persistent storage.
12. The ISMS shall send updates to web-based client session through use of Rest APIs via API Gateway.

13. RESTful API shall allow the users to redact Personal Identifiable Information (PII) from the system in order to meet GDPR requirements.
14. ISMS shall allow end-users to configure specific REST Clients with offline detection providing the ability to alert if no requests have been received in a specific configurable time window.

J. ACCESS CONTROL

1. The ISMS shall be capable of programming an unlimited combination of access control, security alarm, and I/O parameters subject to hardware configuration, and performance/memory limitations within each IFC.
2. For ease of programming, cardholders shall be grouped into groups sharing the same access criteria.
3. Individual cardholders may be assigned an extended door unlock time, as may be required by cardholders with a disability.
4. It shall be possible to assign an individual cardholder to an access group on a temporary basis with predetermined start and finish times.
5. During the period of temporary access, the cardholder shall have the rights of the group to which they have been assigned in addition to any permanent access rights they may have been assigned.
6. The access group details page shall display both permanent and temporary access members with the status of temporary members shown as:
    a. pending (with the start and finish times)
    b. active
    c. expired
7. Any cardholder or access group in the ISMS shall be able to be programmed to have access to any combination of controlled doors in the ISMS with each period of access for each door controlled to within the nearest minute.
8. The IFC shall check entry based on all the following criteria:
    a. correct facility code
    b. authorized card in database
    c. correct issue number
    d. authorized door / access zone
    e. authorized day and time
    f. valid card holder competencies

g. correct PIN (If PIN entry is required)

h. double entry (anti-passback, anti-tailgating, or escort modes)

9. Anti-passback mode shall be able to be configured in any of the following modes:

   a. deny second access to an area if a valid exit has not previously been registered and generate an alarm (hard anti-passback)

   b. allow second access to an area if a valid exit has not previously been registered but generate an alarm (soft anti-passback)

   c. exclude specific access groups from the rules defined in (a) and (b) above

10. Anti-passback rules shall be able to be rearm by:

    a. automatically after a pre-arm period after valid entry

    b. automatically at a standard time each day

    c. automatically on exit from site

    d. manually as an override

11. The ISMS must support global anti-passback allowing multiple access zones to be linked for anti-passback, across multiple IFCs utilizing encrypted peer-to-peer communications.

12. The IFCs shall not rely on the server for anti-passback operation. Global anti-passback shall work across multiple IFCs, even if the server is offline.

13. The anti-passback capability of the ISMS shall enforce anti-passback on a single cardholder for the use of multiple credential types (e.g. mobile phone, keyfob, Mifare card).

14. Anti-tailgate mode shall be able to be configured in any of the following modes:

    a. disallow exit from an area if a valid access has not previously been registered and generate an alarm (hard anti-tailgate)

    b. allow exit from an area if a valid access has not previously been registered but generate an alarm (soft anti-tailgate)

    c. exclude specific access groups from the anti-tailgate rules

15. Anti-tailgate rules shall be able to be rearm by either:

    a. Automatically after a pre-arm period after valid entry

    b. Automatically at a standard time each day

c. Manually as an over-ride

16. The IFCs shall not rely on the server for anti-tailgate operation. Global anti-tailgate shall work across multiple IFCs, even if the server is offline.
17. The anti-tailgate capability of the ISMS shall enforce anti-tailgate on a single cardholder for the use of multiple credential types (e.g., mobile phone, keyfob, card).
18. Every incorrect PIN attempt shall be notified at the central control as an alarm condition.
19. The IFC based upon ISMS programming shall be capable of automatically switching the access mode of a door at different times of the day based on control parameters received from the ISMS. The following access criteria modes are required:
    a. free access (no credential required)
    b. secure access (credential required)
    c. secure and PIN access (credential and PIN required)
    d. override from reader - members of specific access groups shall be able to change the access and PINs mode of the door at predetermined times
    e. dual authorization - access is granted when two different but legitimate cards are presented within a given time frame
    f. escort - a second card is required to be presented from a designated escort cardholder
    g. shared code - The ISMS operator determines what the code will be and programs this into the ISMS. Access is allowed through the door when the correct code is entered
20. Cardholder access reporting to the ISMS and logging in the audit trail shall be configurable in two modes:
    a. only when there has been a successful presentation of a valid access card or token and the door open sensor has detected the door has opened
    b. whenever there has been a successful presentation of a valid access card regardless of whether the door has been opened
21. Readers with integrated PIN pads shall provide an “Entry under Duress” feature.
22. Duress shall be initiated by the cardholder by incrementing the last digit of their PIN number by one.

a. There must be no indication of a duress entry at the reader.

b. When a duress alarm is raised at a reader a critical priority “Duress Alarm” shall be displayed at the ISMS.

c. It must be possible to configure the ISMS such that duress or other selected critical alarms pop to the front of the display, ensuring immediate operator attention. The existence of lower priority incoming alarms shall be visible to the operator but must not interrupt their current task.

23. Zone counting shall be available to provide real-time counting of cardholders in access zones.

24. The result of the number of cardholders in the zone being outside of the specified range(s) shall generate an event or an alarm, depending on ISMS configuration.

25. The minimum and maximum numbers of cardholders in a zone before an event is generated shall be configurable.

26. It shall be possible to arm a “grace time” (in seconds) to allow the zone count to be outside the minimum within the mid-range or outside the maximum number of cardholders without generating an event.

27. It shall be possible to assign a specific message for each of the minimum, mid-range, or above-maximum conditions.

28. It shall be possible to arm up the ISMS to prohibit one cardholder from being alone in a zone by:

    a. requiring two valid but different cards to access a zone should the zone count reports zero cardholders in the zone

    b. requiring one card to access a zone should the zone count report two or more cards in the zone

    c. requiring one card to exit from a zone should the zone count report three or more cards in the zone

    d. requiring two valid but different cards to exit from a zone should the zone count report two people present

    e. prohibiting authorized exit from a zone and generating an alarm if the zone count reports one cardholder present

29. It shall be possible to increment and decrement zone counting based on physical inputs not related to access events.

30. It shall be possible to increment and decrement zone counting based on logical inputs not related to access events.

31. It shall be possible to schedule an access zone for a “First Card Unlock” mode, whereby the access zone is scheduled to go to free access, but only when a suitably privileged card is badged at the reader. All other cards will be granted access but will not be able to arm the door to free access unless they have the “First Card Unlock” privilege.
32. It shall be possible for suitably privileged cardholders to toggle the access mode of a zone between free and secure by badging their card at the reader twice in quick succession.
33. It shall be possible for suitably privileged cardholders to log on to a reader with a keypad either by a credential or credential and PIN and change the access mode of the zone to either free or secure.
34. In addition to unlocking a door when granting access, it shall be possible to activate an additional output or macro which is uniquely related to the cardholder or access group to which they belong.
35. It shall be possible to “lock down” specific areas of a site such that cardholders who would usually have access, are denied access. Cardholders with suitable privileges such as security personnel will still have access. The “lock down” should be activated and/or cancelled by the following methods:
    a. clicking an icon on a site plan
    b. triggered based upon an event within the ISMS
        1) triggering from a preprogramed macro
        2) triggering from the result of a preprogrammed logical expression
        3) triggered from a physical or virtual input

K. CARDHOLDER MANAGMENT

1. The cardholder database table shall be structured so that the name field is the master field for each record. A background unique identifier may be used as the key field for each record, but this must not be required by an operator to identify a cardholder. Use of the card number as the key field is not acceptable.
2. The system must allow a minimum of 15 credential issue levels per card or token. This must deny access and raise an alarm to the operator when a wrong issue level is presented to a reader.
3. Cardholders must be able to be issued with more than one unique access token (i.e. access card, biometric identification, and vehicle token) whilst maintaining only one cardholder record in the database.

4. Where biometric identification is required, the biometric data shall be a property of the cardholder record.
5. Encoding and printing cards shall be properties of the cardholder record.
6. The options for encoding and printing shall be:
    a. print card
    b. encode card
    c. print and encode card in a single operation
7. It shall be possible to prevent the duplication and/or re-printing of cards on a per operator basis.
8. Where a PIN is assigned to a card it should be stored in the database of the ISMS not as part of card data.
9. There must be an option to save a copy of the PIN for later retrieval for forgotten PINs, if this option is not selected then a cardholder's PIN will be saved in a one-way hash to the database.
10. Card numbers shall be enrolled against a cardholder by manually entering the card number or in the case of any Mifare technologies, a reading device connected directly to a workstation.
11. Access groups shall be linked to cardholders by both assigning access groups to cardholders or cardholders to access groups.
12. At least 64 user-definable data fields shall be provided which may be selectively reported on.
13. Cardholder Personal Data Fields shall be able to be configured as:
    a. numerically sorted to prioritize position on the cardholder property page
    b. text; user data may be entered
    c. text list; operator selects text from a pre-prepared list of text strings
    d. numeric; operator must enter numeric data
    e. date; calendar dates may be entered based on the workstation date format
    f. image; the field may only contain an image
    g. email; the field contains an email address to be used for communication by the ISMS
    h. mobile number; the field contains a mobile number to be used for communication by the ISMS

14. Cardholder Personal Data Fields shall have the following characteristics:
    a. default value; the field has a default value assigned
    b. no default value; default value disabled
    c. required field; the value may not be null
    d. unique values; data must be unique from all other cardholder records
15. Cardholder data fields shall support regular expression rules to ensure data accuracy. Examples: @ in email addresses; employee codes are in the correct format.
16. It shall be possible to group or filter cardholders for the purposes of editing access, generating reports, and assigning operator privileges.
17. The following information fields shall optionally be displayed on the cardholder editing window:
    a. the date when a cardholder record was created
    b. the date when the record was last modified
    c. access groups that a cardholder is a member of
    d. for ease of programming, cardholders shall be grouped into access groups sharing the same access criteria and default cardholder personal data fields
    e. it shall be possible to allocate start and end dates and times for an access groups membership
    f. cardholder additional data fields including images which may include photos, signatures etc.
    g. allocated cards
    h. it shall be possible to enter an expiry date/time for the card
    i. cardholder qualification information (competencies) relating to fields such as “Security Clearance”, “Safety Induction” etc.
    j. URL links to additional information which may be located on internal or external web servers
18. Credential validity period shall incorporate start dates, end dates, start time and end time. Start and end times configurable to within one minute.
19. The system shall be capable of importing database information, on selected cardholders, from other systems and be capable of exporting that cardholder’s data, either with or without controlled alteration or amendment to other databases.

20. The system shall support the capability to allow bulk changes to cardholder records. It shall be possible to carry out the following changes as a bulk change:
    a. delete selected cardholder records
    b. change custom cardholder data fields
    c. change cardholder card details
    d. change cardholder access options
    e. change cardholder division assignments
    f. delete cardholders based upon the credential state
21. A bulk change shall be able to be saved and scheduled to run at a later time.
22. A window shall be provided to show details of created, saved, edited, pending, successful, and failed bulk changes.
23. A personal user code (4 to 8 digits) shall be a property of the cardholder record to allow access via readers with a keypad and to arm and disarm alarms.
24. Operator management shall be a property of the cardholder record.
25. A change history record associated with each cardholder record shall list all changes made to a cardholder record, including details of which operator or API login made the changes.
26. The system shall support an event trail for the cardholder which details recent card usage events for the cardholder as well as operator events which have modified the cardholder record.
27. The number of prior events to be shown or prior length of time to be covered shall be configurable.
28. The system shall allow different prior length of time / number of prior events to be displayed for different operators.
29. The cardholder record screen shall display a real-time event trail of cardholder activity.
30. The system shall allow an operator to search for a cardholder:
    a. by entering any part of their first and/or last name, in any order and separated by a space if using both. After three characters have been entered the system shall automatically return matching results and filter these dynamically as the operator continues to type.
    b. by entering Boolean logic, logical or wildcard operators, or defined

conditions / filters.

31. The system shall allow the cardholder search fields and search results to be configurable. The system shall allow different operators to use and see different search fields and search results for cardholder administration tasks.
32. The system shall allow the information returned for a cardholder and visible to the operator to be configurable and include any sub-section of the total information stored in the cardholder record (e.g., custom data fields, cards, access groups, biometric information etc). Different operators shall be able to view different subsections of the cardholder information.
33. It shall be possible to locate a cardholder record by presenting their card to a reading device connected directly to an operator's workstation.
34. The system shall allow cardholder information to be viewed and updated in one screen.
35. Configuring operators shall, subject to the required privileges, be able to design a single screen cardholder management view adapted for the specific screen resolution of the operator(s) who will use the view, to ensure best use of available screen real- estate.
36. The system shall be able to display up to 30 historical cardholder activity items instantly in a viewer.

L. PHOTO ID BADGING AND IMAGE MANAGEMENT

1. The ISMS shall be provided with an integrated card design component. The ISMS shall be capable of accepting previous access card designs and credentials into the new ISMS
2. The ISMS shall provide a means to:
   a. electronically capture images
   b. store the images in the server database
   c. integrate those images into a pre-designed ID card from within the system
   d. produce an integrated and finished identification card
   e. The ISMS must be capable of storing at least three images per cardholder
   f. Encoding proprietary and third-party cards on one system
3. The ISMS offered shall capture images in 24-bit color and at least 800 x 600-pixel resolution, using standard video capture hardware offering a TWAIN, Direct Draw standard interface, or a USB digital camera.
4. Images must be able to be cropped after capture to optimize the image size

within the desirable image area. This size of the movable cropping box must be user definable.

5. The image capture editing controls must be integrated into the system software.
6. The ISMS shall store images in the JPEG compression format. User definable compression rates shall be easily selectable by the operator, a minimum of three levels of JPEG compression are required.
7. The ability to import background images from other sources into the card designer
8. The ISMS offered shall be capable of importing image files, for use in either card layout or cardholder images, from at least the following formats:
    a. JPEG
    b. Windows BMP
9. The card design must be capable of incorporating, storing, printing, and displaying barcode information and must support the following barcode formats:
    a. EAN 13
    b. EAN 128
    c. UPC A
    d. UPC E
    e. Code 39
    f. Code 128
    g. Interleaved 2 of 5
    h. Codabar
    i. Telepen
    j. PDF417
10. The card design must be capable of user-selecting up to 16.7 million colors (RAL) with a custom color palette available.
11. Card design must be accomplished using drag and drop feature.
12. Card design must support both sides of the card.
13. The system shall be capable of linking data relating to the cardholder and printing it on the card. This data shall include (but not be limited to):

a. first name

b. last name

c. card number (displayed as text and/or barcode)

d. card issue level

e. expiration date

f. personal data as defined in the cardholder database

14. The system must be capable of using all installed word processing fonts and must also be capable of normal text manipulation including, text sizing, left and right justification, centering, bolding, underlining, and italicizing.

15. The image files that are selected to incorporate into the card design must be scalable on the card. When scaling the image, the card designer must offer automatic aspect ratio adjustment throughout the size range.

16. The system shall be capable of producing hard copy output of images and data using any standard MS-Windows printer.

17. Cards must be capable of either landscape or portrait printing and barcodes must be capable of either vertical or horizontal orientation on the card when printed.

M. SITE PLANS

1. It shall be possible to manage and monitor alarms, overrides, the general real-time status of site items, and change device state (example: release a lock) through the operator GUI with the use of interactive dynamic site plans, and icons.

2. The designing and editing of a site plan shall allow:

a. The basic editing tools to assist in the design and creation of the site plan.

b. Assigning icons to ISMS functions and place these at any position on a site plan.

c. Provision for drawing lines and shapes to form objects shall be available. These objects shall be able to be associated with ISMS items allowing ISMS item status to be visually indicated by the object.

d. It shall be possible to place free text onto a site plan.

e. An optional grid shall be available with snap-to-grid available for all objects and vertices.

f. Individual objects within a site plan shall be able to be moved behind and in front of other objects using a layer scheme.

g. An alignment tool shall be provided to align groups of objects in both x and y dimensions.

3. External drawings shall be able to be imported into the ISMS from external drawing software. The ability to import common and the following file formats shall be supported:
   a. EMF
   b. PDF
   c. PNG
   d. WMF
   e. BMP
   f. JPEG
   g. GIF
4. It shall be possible to design and load icons from external software for use in the ISMS.
5. It shall be possible to design interactive buttons to reside on site plans. On activation, the buttons must be capable of performing multiple overrides for ISMS items simultaneously.
6. When an object is selected on a site plan, it shall present an interactive menu to the operator. All the following functionalities must be included:
   a. View the current status of a door, input, or output
   b. override a door, input, or output
   c. monitor and acknowledge an alarm
   d. lock/unlock an access-controlled door
   e. change an unlock schedule on a door
   f. move from one site plan to another
   g. activate an intercom
   h. override an alarm, access, or perimeter fence zone state
   i. optionally display zone counts (right click or hover)
   j. generate a report
7. Site plan usage shall support touch-screen technology and preclude the use of a mouse right-click as a separate function.

8. Site plans shall be capable of pan and zoom functionality.
9. All open site plans shall be updated immediately if that site plan is amended at any workstation.
10. Icon names shall use the item name by default, but a shortened name shall be configurable so as not to clutter the site plan with text.
11. The ISMS shall support a search functionality that when searching for an object, it will return a site plan containing the object.
12. There shall be provision for sending a copy of the currently visible site plan to a printer, email, or Windows clipboard, natively within the ISMS workstation application.
13. The site plan shall provide a means to show or hide objects at predetermined zoom levels to assist in reducing clutter on a highly populated plan.
14. When zooming out of the site plan, objects must consolidate into a summarized indicator.
15. A site plan must support multiple floor layers in a single site plan item.
16. When panning a site plan, a secondary site plan must automatically present itself when the display pans over the location of that site plan that represents that sub-area.
17. Site plans shall allow icons for third party devices
18. Site plans shall allow background color selection
19. Site plans shall allow the user to customize its orientation
20. Site plans shall allow the user to implement the following:
    a. Provide options to hide and display items dependent on zoom levels
    b. Embedded site plans
    c. Have the ability to link separate panels and incorporate related items
21. Site plans shall allow intercom integration allowing for the following functions:
    a. A fold-away intercom call queue which drives the navigation to the relevant intercom on the site plan
    b. Ringing behavior on the intercom/door icons
    c. Popup controls allowing management of an intercom calls

N. REPORTS

1. The ISMS shall provide report generation capabilities from the following

sources of information residing in the database:

a. system activity and health data

b. IFC, readers and all associated ancillary device warranty status.

c. cardholder access data

d. cardholder data fields

e. cardholder access rights

f. system / site configuration

2. The report generation feature shall be easy to use and based on a “checkbox” style of parameter selection and preparation. The report preparation process shall provide features to simplify report generation by incorporating time period selections such as “yesterday”, “last week”, “last month” etc. When these time-based selections are used in a saved report it will dynamically produce a report relevant to the time the report is run.
3. Report cover page, header, and footer, shall be configurable per report.
4. It shall be possible to re-order report columns.
5. It shall be possible to resize report columns.
6. The parameters for producing the report must be fully user definable and must be capable of searching on any cardholder or event criteria.
7. It shall be possible to produce the following types of reports:

   a. any site activity

   b. last known location of all cardholders on site, with cardholder count summary,

   c. unprocessed alarms, un-acknowledged alarms and doors temporarily overridden from secure to free

   d. details pertaining to cardholders, including images

   e. time-and-attendance based reports

8. Reports shall be able to be saved for future use.
9. There shall be no limit imposed on the number of reports that can be saved.
10. It shall be possible to copy a report to be used as a template for another report.
11. The report shall be generated by any of the following means, as may be required by the operator:

a. within the report editor

b. manually triggered from within a map display

c. triggered by a hardware or software event

d. a one-time or recurring schedule

12. The ISMS shall generate and format reports as a background process. This means the operator must be able to process alarms, alter database parameters and perform other system changes while the report is being generated. Report generation must continue if the operator decides to perform any other task.

13. The ISMS shall have a screen preview function, so that reports can be previewed during report preparation and on-screen before they are printed.

14. The report generator shall be capable of exporting reports in the following formats:

    a. Adobe PDF (.PDF)

    b. Microsoft Word (.DOCX)

    c. Microsoft XPS (.XPS)

    d. Microsoft Excel (.XLSX)

    e. image file (.JPEG)

    f. CSV file with header (.CSV)

    g. CSV file without header (.CSV)

15. It shall be possible to email reports to nominated people or groups of people using the above format.

16. The email capability shall be available from within the ISMS itself. Applications that require reports to be generated, saved to a file and then emailed using an external email application will not be acceptable.

17. The report generator shall be capable of supporting wildcard searching when filtering data for reports.

18. It shall be possible for operators to change report parameters when generating reports.

19. Reports shall be able to be printed at any network-supported printers accessible to the ISMS.

20. The Time Reporting section of reports shall offer a “Shift” selection allowing end-users to run reports across cardholders working different shift patterns.

This reporting is utilized to assist with contractor billing reconciliation, safety, compliance and fatigue management.

21. The ISMS shall be able to produce voltage reports for a networked energized fence.
22. The energized fence voltage reports shall be displayed in graphical form showing the energized fence voltage along with the date and time.
23. The ISMS shall be able to produce temperature reports for a networked energized fence controller.
24. The networked energized fence controller temperature voltage reports shall be displayed in graphical form showing the energized fence controller's temperature along with the date and time
25. Operator privileges shall differentiate between:
    a. report preparation and configuration
    b. report generation only (not allowed to change the configuration)
26. It shall be possible to generate reports with graphical representations of data for trend analysis in the following formats:
    a. bar graph
    b. pie graphs
    c. line graphs
    d. summary report data shall be available in a table format
27. ISMS shall be able to change the start of the reporting week as required

O. NOTIFICATIONS

1. Specific event and alarm messages shall be able to be configured to be sent to nominated users via either email, SMS message, or mobile device application.
2. It shall be possible for persons receiving alarm messages to be able to acknowledge the alarms via return email or SMS message.
3. It shall be possible to send notification of imminent card or competency expiry to an individual, their manager or other nominated person.
4. When emailing cardholder details, it shall be possible to send an image of the cardholder from their personal data record.
5. A comprehensive filtering feature shall be provided to manage notification information transmission.

6. It shall be possible to schedule the notifications.
7. The notification may be triggered via a pre-configured alarm condition removing the need for operator intervention.
8. The notification system shall support OAuth 2.0 via Entra ID.

P. BULK NOTIFICATIONS

1. The ISMS shall allow for the broadcasting of notification messages to multiple recipients directly from the server.
2. The privilege to send the notification must be separate from the permission to create and see the notification.
3. Preconfigured messages shall be created that may then be sent with a single action by an operator or as a system triggered message.
4. The notification may be sent to groups filtered by previous access time, cardholder creation or modification date, access card type, or specific cardholder data criteria.
5. Notifications shall have the ability to be send to dynamically updated groups based upon cardholder location in the ISMS.

Q. AUDIT TRAIL

1. The ISMS server hard disk shall be used to record all system activity for auditing purposes.
2. All system activity event along with all details, including but not limited to the following list, shall be time stamped with the time of occurrence at the IFC and also the time the event was received by the server, to the nearest second, and shall be recorded in the system activity log for archiving:
    a. all access attempts (allowed and disallowed)
    b. alarm events
    c. system events
    d. operator activity
3. The central control shall provide a facility to archive system data and event records to an archive file to free database space for further activity logging.
4. It shall be possible to archive the data to a network device by specifying a UNC path.
5. The archive process shall be initiated by either manual operation or automatically on a schedule.
6. It shall be possible to nominate the number of days of data that shall remain in

the database after an archive process.

7. The ISMS reporting functionality shall return results from both live database and archive as a single contiguous report.
8. The system shall allow the workstations to acquire OnDemand subscriptions to the following and terminate these subscriptions after 5 minutes of inactivity
    a. Event Viewer
    b. Event Trail title
    c. Event Trail title

R. MOBILE DEVICE APPLICATION

1. The ISMS shall have a mobile device application which allows operators to remotely manage the ISMS via a smart phone or tablet. Dedicated devices with a single hardware option shall not be acceptable.
2. The mobile device application must be available on both Android and iOS operating systems.
3. The mobile device shall connect to the ISMS via:
    a. Wi-Fi
    b. Mobile carrier data connection
4. Mobile devices shall be enrolled in the ISMS by way of an authorization code generated on the ISMS.
5. The mobile device connection must have the option of connecting to the ISMS server via an HTTPS proxy.
6. It shall be possible for the mobile device screen to lock after a preconfigured period of inactivity.
7. The mobile device shall be able to manage ISMS alarms:
    a. Alarms shall be displayed in different colors to denote the priority.
    b. The alarms shall have a flashing indicator when unacknowledged.
    c. The alarms will have a constant color indicator when acknowledged.
8. When multiple instances of the same alarm occur within a user-defined time frame, the mobile device will present alarms as a group and display the number of alarms in each group.
9. The application will display the following alarm status:
    a. alarm condition is still in an active state

b. alarm priority has been escalated

c. multiple occurrences of the same alarm within a user-defined time frame

10. The mobile device operator will be able to view alarm details such as:
    a. priority
    b. source of the alarm
    c. date and time
    d. alarm history
    e. contextual instructions on how to proceed resolving the alarm
11. The mobile device operator will be able to perform operations on the alarm such as:
    a. add notes to the alarm
    b. acknowledge alarms
    c. process alarms
12. The mobile device operator will be able to filter alarms by (but not limited to) the following states:
    a. priority
    b. acknowledged
    c. unacknowledged
    d. active
    e. inactive
    f. division
13. The mobile device shall be capable of monitoring the status of ISMS items such as (but not limited to):
    a. doors
    b. access zones
    c. alarm zones
    d. fence zones
    e. macros
14. It shall be possible to search for items monitored by the mobile device by selecting from a list or entering part of the text relating to the item name.

15. The mobile device shall be able to override items such as (but not limited to):
    a. doors
    b. access zones
    c. alarm zones
    d. fence zones
    e. macros
16. The mobile device shall be able to lock down an access zone such that all cardholder access is disabled, excluding specifically authorized cardholders.
17. The mobile device shall have the capability to display the individual cardholders that are located in any access zone configured on the ISMS server.
18. The mobile device application shall have the ability to read Mifare DESFire EV3 credentials using the native NFC antenna of the mobile device.
    a. It shall be possible for the mobile application using NFC antenna to log a cardholder into or out of an access zone in the same manner as if the cardholder presented their card to a fixed access control reader.
    b. The cardholder credentials shall be authenticated by the ISMS and displayed in the user interface, clearly indicating an access granted or denied decision.
    c. Access granted and denied decisions shall be indicated by different audio tones.
    d. It shall be possible to continuously read cards without pressing any additional “Read Card” buttons.
19. The mobile device shall be able to manage cardholders.
20. It shall be possible to search for cardholders by selecting from a list or entering part of the text relating to the cardholder name.
21. It shall be possible to search for cardholders based on (but not limited to):
    a. card number
    b. user defined data fields such as company, department, employee ID number, license plate etc
22. The mobile device shall display (but not be limited to) the following cardholder information:
    a. name

b. the last entered access zone, including date/time

c. image

d. access groups

e. user defined data fields

f. access credentials

23. Data fields such as email address, phone number etc. shall be hyperlinks to enable the operator to click on the field and automatically be taken to the default email or phone application.

24. If a cardholder is not authorized for access, or has no active access groups, or has no active token, a highlighted message shall appear on the screen to alert the operator.

25. Is shall be possible to disable a cardholder's access via the mobile device.

26. The mobile device shall be able to validate a searched for cardholder:

    a. It shall be possible to conduct a spot check of cardholders whereby the operator can view the access credentials of the cardholder on the Mobile device and record whether the cardholder passes an ID check and has the appropriate access rights to their current location.

    b. The operator shall select a "Pass" or "Fail" which will be logged at the central server.

    c. It shall be possible for the operator to select user-definable reasons for the pass or fail.

    d. It shall be possible for the operator to enter free text into a notes field.

    e. It shall be possible to record the location of the mobile device to indicate where the spot check took place.

27. The mobile device shall be capable of reading barcodes.

28. Upon reading a barcode, it shall search for and display cardholder details based on the barcode identifier.

29. The barcode identifier associated with the cardholder must support alpha-numeric characters. Numeric only will not be accepted.

30. The mobile device shall be capable of reading (but not limited to) the following barcode formats:

    a. Aztec Code 2D

    b. DataMatrix 2D

c. PDF417 2D

d. QR Code 2D

e. Macro PDF417 2D

f. Semacode 2D

31. The mobile device shall be capable of reading supported cards

32. ISMS shall allow the mobile version of the application to connect securely from anywhere on the internet hence removing the need for the mobile end point to be on a VPN or corporate network.

33. The mobile application shall display a selected profile image for cardholders who have been assigned this feature.

S. COMPETENCIES

1. Competencies shall be cardholder-based assignable attributes, used to determine if the cardholder is allowed access to specified areas based on factors relevant to the cardholder. The factors may be based on authority, or skill levels, or similar.

2. Multiple competency attributes may be assigned to one or more cardholder records.

3. Each competency will assume one of 4 different states:

   a. Active - The competency is currently valid for the cardholder.

   b. Expiry due - The competency is currently valid for the cardholder but will expire in a specified period.

   c. Expired - The competency has been assigned to the cardholder but has expired.

   d. Disabled - The competency, is temporarily disabled (or overridden) for the cardholder.

4. The competency states shall be configurable as “soft” - allowing access but generating an alarm; or “hard” - denying access, should a competency requirement not be met.

5. Each competency shall be individually arm per cardholder.

6. A field shall be provided to store the reason for disabling a competency.

7. Competencies shall be configured as required per access zone.

8. It shall be possible to exempt specific access groups from the requirement to meet specific competencies.

9. Denied access due to an invalid or missing competency shall be displayed to the user at the door reader.
10. Access permission based on competency criteria must be determined at the IFC, independent of the ISMS being on-line.
11. The reason for denied access due to an invalid competency shall be displayed on the door reader or keypad.
12. Advance warning of a cardholder's competency about to expire shall be sent to the individual and/or other nominated persons via email.
13. A consolidated report detailing competency expiry warnings for cardholders shall be sent via email to the associated manager.

T. RANDOM SELECTION

1. The ISMS shall have an integrated component for selecting cardholders using a completely random or pseudo-random criteria when they badge at a door.
2. The ISMS shall display a customizable message at a door's reader when the cardholder is selected.
3. The ISMS shall allow for configurable allowance or denial of access when the cardholder is selected.
4. The selection criteria shall be configurable with the following options:
   a. the maximum number of times that a single cardholder may be selected over a given period of time
   b. the total number of cardholders that may be selected over a given period of time
   c. that all cardholders must be selected at least once over a period of time
5. The selection algorithm must be able to function on the IFC without the aid of the ISMS server.
6. The selection algorithm must be able to differentiate between different groups of cardholders and assign a varying probability selection to each.

U. ELEVATOR CONTROL AND MANAGEMENT

1. The ISMS shall provide fully integrated elevator control facilities. The elevator control access equipment must communicate with the same central control as the door card readers.
2. The elevator control architecture shall comprise a card reader in each elevator car, reporting to elevator control interface equipment mounted in or near the elevator motor room. Reader type shall be as specified for use on access control doors.

3. The elevator control system shall be capable of controlling access independently in a number of elevator shafts simultaneously.
4. The elevator control system shall incorporate dedicated intelligence and a local database of authorized cardholders.
5. Each elevator reader shall be identified independently at the central control by means of a unique plain language descriptor. The central control plain language descriptor shall be at least 60 characters in length.
6. The ISMS shall raise an alarm if the elevator reader stops communicating with its elevator controller.
7. The elevator control shall check entry based on all of the following criteria:
    a. correct facility code
    b. authorized card in database
    c. correct issue number
    d. authorized level
    e. authorized time of day
    f. correct PIN (If PIN entry is required)
8. The access mode for each floor of an elevator shall be capable of automatically changing according to the programmed time schedules, as received from the central control. The following access criteria modes are required:
    a. free access (no credential required)
    b. secure access (credential required)
    c. secure and PIN access (credential and PIN required)
    d. dual authorization - access is granted when two different but legitimate cards are presented within a given time frame
    e. escort - a second card is required to be presented from a cardholder who is nominated in a specified access group
    f. shared code - The ISMS operator determines what the code will be and programs this into the ISMS. Access is allowed through the elevator when the correct 4-digit code is entered
9. Levels must be securable on a level-by-level basis, using command instructions transmitted from the central control.
10. The central control must provide operator override facilities to enable

temporary override capability on a level-by-level basis.

11. Where a low-level interface is specified:
    a. The interface between the access system elevator control equipment and the elevator switching control equipment shall be via dry relay contacts.
    b. The voltage from the elevator system connected to the relays shall not exceed 24 volts DC/AC.
    c. The elevator control system shall provide one relay contact per elevator shaft per level for the ISMS. This relay contact shall be used to interface with the elevator switching control equipment.
    d. An input shall be provided for each level per elevator to indicate what level the user selected. On activation of this input all relays return to secure state.
12. Where a high-level interface is specified:
    a. The interface between the access system elevator control equipment and the elevator switching control equipment shall be via RS-232 or TCP/IP connection depending in the elevator system requirements.
    b. The elevator control equipment will provide feedback as to which level was selected by the cardholder.

V. PRE-PROGRAMMED OVERIDE MACROS

1. To allow for making changes to the ISMS configuration on demand, it shall be possible to pre-configure the required changes and assign them to a macro action.
2. Macro actions shall be capable of (but not limited) the following:
    a. open doors
    b. change door modes such as free, secure, secure with PIN, dual authority
    c. anti-passback forgive
    d. active and release zone lock down
    e. rearm the cardholder count in a zone
    f. switch an output on and off
    g. activate the generation of pre-configured reports
    h. initiating another macro
3. A macro shall be capable of activating multiple actions from within a single macro. There shall be no fixed limit to the number of actions that can be

configured.

4. An operator shall be able to initiate the macro via either a menu item or by a site plan icon.
5. Macros shall be capable of being activated by any ISMS events.
6. Macro configuration must be by the use of GUI features such as drop-down lists and drag and drop techniques. The use of script language to write macros is not acceptable.
7. It shall be possible to initiate macros based on a on a time schedule.
8. Macros shall be able to execute Microsoft Windows command line actions.
9. Up to 300-character variables shall be able to be specified for each command line.
10. Each macro shall be able to contain multiple command line entries.
11. The configuration and execution of command line macros shall be user account name and password protected. These usernames and passwords shall be obscured on entry and transmitted and stored at the central command ISMS server in an encrypted format.

W. SYSTEM INTEGRATION

1. The ISMS shall support OPC AE Protocol
   a. The OPC AE interface shall allow third party OPC clients to subscribe to
   b. receive alarms and events from the ISMS.
   c. When an alarm is processed, the OPC AE client shall send an event processed message back to the ISMS to process the alarm on the ISMS.
   d. The ISMS shall support multiple simultaneous OPC AE connections.
2. The ISMS shall support OPC DA protocol.
   a. The OPC interface shall support OPC DA specification 2.0 and 3.0.
   b. The OPC DA interface shall allow the status of system components to be reported to an external OPC DA client.
   c. The OPC Interface shall allow third party OPC DA clients to generate system component overrides including but not limited to alarm zone and access zone overrides.
   d. The ISMS shall support multiple simultaneous OPC DA connections.
3. The ISMS shall support a REST Web Service API.

a. The ISMS cardholder functionality shall support a REST Web Service to allow an external system to create, remove, and modify cardholders, including assigning access rights.

b. The ISMS alarms and events functionality shall support a REST Web Service to allow external systems to receive alarms and events from the ISMS.

c. The ISMS shall provide a REST Web Service that will allow a third-party system to perform actions in the ISMS such as open doors, disarm alarm zones, and turn an IFC output on.

d. The ISMS shall support a REST Web Service that will allow a third-party system to interrogate the status of ISMS items such as doors, alarm zones, and IFC inputs.

4. The ISMS shall allow data exchange with other applications using XML protocols.

   a. The system shall provide an XML interface to allow for the import, export, and synchronization of data in an on-going basis from other applications directly into the cardholder database both in a real-time manner and in a batch-oriented approach. A developer's kit with a sample application shall be readily available.

   b. The system shall provide an XML interface to allow for updating access control schedules from other applications directly into the ISMS database in both a real-time manner and in a batch-oriented approach. A developer's kit with sample application shall be readily available.

5. The system shall provide a tool which allows configuration and synchronization of cardholder data with third party systems via a csv file. The CSV import functionality shall support the following functionality:

   a. Manually triggered data import

   b. Schedule triggered data import

   c. Images imported via flat file

6. An API that communicates directly to the IFC shall be available

   a. The API shall allow third party systems to pass events to the IFC and for the events to appear in the ISMS event window

   b. It shall be possible for the IFC to be programmed to trigger actions based upon these external events. For example, a video analytic alarm from a video management system is passed to the IFC, the IFC in turn will lock doors and raise and alarm.

c. It shall be possible for a third-party system to send a card number and site code to the IFC to act as a “virtual card reader”.

d. The API shall allow the third-party system to interact directly with the IFC with no reliance on the ISMS server.

7. The ISMS shall support the BACnet communications protocol.

   a. BACnet communication will be via TCP/IP.

   b. The IFC will communicate with BACnet devices with no need for server intervention.

   c. The BACnet integration will enable the IFC to monitor BACnet objects for state changes and raise alarms accordingly.

   d. The BACnet integration will enable the IFC to change BACnet object states in response to events.

8. The ISMS shall support the SNMP communications protocol

9. Events from third party systems shall be managed in the same way as inputs connected directly to IFCs.

10. Interactions with third party systems shall be logged in the ISMS.

11. ISMS shall support smart sensor integration which detects the following

    a. Masking

    b. Air quality

    c. Volatile organics

    d. Vaping

    e. Gunshot

    f. Tetrahydrocannabinol (THC)

    g. Fine particulate matter (PM 2.5 and PM10)

    h. Ammonia

    i. Nitrogen dioxide

    j. Carbon monoxide

    k. Carbon dioxide

    l. Help keyword

    m. Aggression

    n. Barometric pressure

o. Light level

p. Temperature

q. Humidity

r. Tampered

s. Sound level

12. The ISMS shall have the ability to integrate with SIP intercoms and provide the following functionality:

    a. Answer calls from the ISMS

    b. Call a SIP intercom from ISMS

    c. Please a call on hold

    d. Hanging up a call

    e. View video for an intercom at 720p resolution

    f. Grant access

X. VIDEO MANAGEMENT SYSTEM INTEGRATION

13. The ISMS shall be capable of concurrently interfacing with VMS from multiple vendors.

2. It shall be possible for the ISMS to view live video from multiple cameras within its interface.

3. The ISMS shall be capable of viewing stored (archived) video from the VMS within its interface.

4. Where supported by the integrated VMS, it shall be possible to operate camera controls such as:

    a. PTZ

    b. pause

    c. forward

    d. rewind

5. It shall be possible to maximize a camera window.

    a. Whilst a camera window is maximized, the other camera windows should be changed to live thumbnail images to ensure the operator is able to see activity in all cameras.

6. It shall be possible to drag a camera icon from a site plan into a video view to dynamically be able to view cameras in an ad hoc manner.
7. It shall be possible to drag a camera icon from a list into a video view to dynamically be able to view cameras in an ad hoc manner.
8. It shall be possible to find a camera from a search box.
9. Where supported by the integrated VMS, it shall be possible for the ISMS to send a message to the VMS to move cameras to priests.
10. Where supported by the integrated VMS, it shall be possible for the ISMS to receive motion detection and video analytic events from the VMS.

Y. DOOR FUNCTIONALITY – CONNECTED TO CONTROLLER

1. Access control for a door shall allow for the following features where specified:
   a. access reader
   b. emergency release switch input
   c. reception control switch input
2. Egress control for a door shall allow for the following features where specified:
   a. exit reader
   b. push button request to exit
   c. emergency exit break-glass
3. A push button request to exit shall record the exit in the event database.
4. When requested by a valid means of access or egress, the door shall unlock for a prearm period, after which the door shall relock.
5. The door relock time shall support three modes of operation:
   a. the door lock output will relock immediately on door open
   b. the door lock output will relock after a door open/close cycle
   c. the door lock output will relock after the configured time regardless of open-close cycles
6. The period of unlock shall be extended should a cardholder have a suitable privilege.
7. All entry and exit methods shall be recorded in the event in the event database.
8. The door shall be monitored for both door open/closed, and door locked/unlocked using concealed monitor switches appropriate for the door

installation.

9. Where the door is a double door, the inactive door leaf shall also be monitored for door open/closed and door unlocked/locked. The inactive leaf door monitor switches may be connected as part of the active door leaf monitoring.
10. It shall be possible to configure the door in a way that generates a forced door alarm should the door be unlocked and/or opened without first being released by the ISMS.
11. Should a door be left unlocked or open after a pre-arm time, an alarm shall be generated reporting the condition.
12. The door open/unlocked warnings shall provide an audible warning at the door.
13. It shall be possible to disable the reader audible warning.
14. It shall be possible to generate the audible warning via a relay connected elsewhere in the ISMS including any other IFC.
15. Should a valid request to access a door be generated and access not taken, this will be recorded as a different event and the door will be re-secured.
16. The ISMS shall have a lock down feature whereby cardholders who would usually have access to doors are denied access.
17. It shall be possible to assign specific cardholders the right to access a door when the door is in lock down, whilst refusing access to all other cardholders.
18. It shall be possible to create an interlock relationship between groups of doors for situations such as airlocks whereby a door cannot be opened until other doors or inputs are closed.
19. Up to 20 doors shall be included in any interlock group.
20. It shall be possible to configure interlock groups via GUI drag and drop functionality without the requirement to write scripted logic.
21. It shall be possible to assign outputs that advise cardholders that there is an interlocked state active.
22. The ISMS shall support a challenge or video verification mode as specified below:
    a. When a card is presented at a reader, images from the cardholder database (as many as required) shall be displayed in the challenge view of an operator GUI.
    b. Associated with the images, it shall be possible to display a video image from one or more assigned cameras.

c. In challenge mode it shall be possible to view a site plan showing the location and status of the controlled entry point and nearby items.

d. In challenge mode it shall be possible for the operator to view the status of the cardholder's cards and competencies for informing the cardholder, at the time of entry, if any expiries are imminent.

e. Related data fields shall also be able to be displayed, associated with the cardholder (name details, department etc).

f. Associated with a challenge entry, the selection and layout on screen of cardholder images, cardholder personal data, cardholder card or competency status, site plans or video images must be configurable using simple drag and drop or click and drag techniques to resize or reposition information.

g. The challenge mode shall be configurable to either:

1) Automatically grant access to a valid card and display the current access decision (granted or denied) to the challenge operator.

2) Require operator intervention to grant access to a valid cardholder.

23. Should a second challenge be requested while an unanswered challenge remains in the ISMS, the second and subsequent challenges shall queue automatically awaiting response.

24. It shall be possible for an operator to view waiting challenge events and to select and process challenge events within the queue in any order they choose.

25. The ISMS shall allow challenge events to be managed from a single full-screen view per operator or multiple filtered views, as dictated by the specification.

Z. DOOR FUNCTIONALITY – DATA ON CARD

1. Where specified, doors shall be managed using an offline door locking system.

2. A single interface shall be provided that allows for administration and reporting including both the online and offline locking systems.

3. The offline doors shall be fully integrated into the ISMS as described below:

a. Card technology shall be contactless Mifare Classic, Mifare Plus, or Mifare DESFire EV3.

b. Card encoding shall be carried out as a single encode operation for both online and offline door readers.

c. Operational data shall be transferred between the ISMS and offline doors

automatically, without the need for specific operator actions. This data shall include:

1) multiple levels of door low battery voltage alarms
2) access activity from all doors
3) blacklisted card information
4) changes to cardholder access privileges

d. Access privileges based on time and day shall be available, with full flexibility in specifying the time intervals or day types for any cardholder.

e. It shall be possible to configure the ISMS to ensure access updates for offline doors are enforced within a given period of time, configurable as a minimum of 1 day.

f. Access privilege changes must not require connection of a management device to the escutcheon (eliminating the need to update each door escutcheon when a user is added or removed).

g. The ability to specify an extended door opening time for specific cardholders shall also be available for offline doors.

h. Offline doors shall support partitioning to allow specific administrators to control and assign access privileges within their own environment/facility.

4. The range of hardware shall include an option for an internal privacy lock which, when activated, prevents entry except for privileged users.
5. Hardware shall not use proprietary batteries. Batteries must be commonly available types.
6. Battery life shall support a minimum of 35,000 operations before replacement is required.
7. The escutcheon hardware shall be compatible with the lock hardware specified for this project.
8. Basic maintenance (changing batteries, changing basic configuration) shall be able to be carried out by general maintenance staff with minimal instruction.
9. The offline escutcheons should be able to hold an audit trail of at minimum the last 1000 events.
10. The offline escutcheons shall be able to function in a variety of modes such as but not limited to, free (unlocked), secure (locked) by schedule or as controlled by a cardholder with privilege to change the escutcheon mode.
11. It shall be possible to change a door state between the free and secure states

using an authorized card.

12. It shall be possible to specify on a user-by-user basis what modes they can place the lock in (e.g. free or secure) and override functions the user can perform (i.e. entry allowed when privacy lock is on).
13. A handheld programming device may be used for the purposes of:
    a. diagnosing problems
    b. performing an emergency opening of an offline device
    c. updating software
    d. provide power to the escutcheon to allow resolving a no battery voltage situation,
    e. initializing hardware
14. Multiple levels of warning for low battery indication including audible, visual and physical warnings (i.e. initially a visual signal progressing to an audible and visual indicator and then finally progressing to an audible, visual and delayed opening of the door to indicate/prompt someone to report the occurrence). One or all may be used.
15. The hardware range shall include the ability to upgrade offline doors to online via wireless through a wireless gateway.

AA. DOOR FUNCTIONALITY – WIRELESS CONNECIVITY

1. Where specified, doors shall be managed using a wireless door locking system.
2. A single, seamless user interface shall be provided within the head end to ensure integrity of access decisions are maintained within the primary access control system.
3. The flow of information from the RFID card shall be transmitted instantaneously to the wireless card reader/lock, (lever set /escutcheon or cylinder type) which shall in turn send the card credentials to the hub and access control system.
4. The ISMS shall provide real-time access decisions as described elsewhere in this specification.
5. Assignment of access privileges for use in both online and wireless doors shall be available through a single interface.
6. Card encoding shall be carried out as a single encode operation for both online and wireless door readers

7. A wireless RS485 communication hub shall support up to 8 wireless locksets and have reliable communication to each reader within 15 meters.
    a. Wireless hubs shall be able to be wired in series with RS485 compatible cable.
    b. The wireless hub shall conform to the radio standard applicable to the region of installation and conform to IEEE802.15.4 (2400 – 2483.5 MHz).
    c. AES-128 encryption shall apply for communication between the hub and each wireless reader.
    d. Up to 16 (installer selectable) channels per hub shall be available to ensure each wireless escutcheon or cylinder is configured with reliable communication.
    e. Hardware shall not use proprietary batteries. Batteries must be commonly available types.
    f. Battery life shall support a minimum of 35,000 operations before replacement is required.
8. The wireless doors shall be fully integrated into the ISMS as described below:
    a. Card technology shall be contactless Mifare Classic, Mifare Plus, or Mifare DESFire EV3.
    b. Operational data shall be transferred between the ISMS and wireless doors automatically, without the need for specific operator actions. This data shall include:
        1) multiple levels of door low battery voltage alarms
        2) access activity
        3) blacklisted card information
        4) changes to cardholder access privileges
9. The escutcheon hardware shall be compatible with the lock hardware specified for this project.
10. Basic maintenance (changing batteries, changing basic configuration) shall be able to be carried out by general maintenance staff with minimal instruction.
11. An installer service tool shall communicate with each wireless hub and enable configuration, management, and override of each door independent of the access control system.

BB. FIELD HARDWARE

1. The IFC shall be the main controller in the field. The ISMS shall communicate

directly with all IFCs.

2. The IFC shall use a Linux operating system, this OS shall be specifically re-developed for security purposes. Applications on a general-purpose OS such as Windows CE, Arduino, or a standard Linux kernel shall not be accepted.
3. The firmware running on the IFC shall be approved by the vendor and support Secure Boot.
4. The firmware running on the IFC shall support Anti-Rollback
5. The IFC shall incorporate Immutable Identity to prevent device counterfeiting.
6. The IFC shall securely store critical cryptographic keys supporting “TrustZone”.
7. Each IFC shall be intelligent such that in the event of failure of power or communications to the ISMS, for whatever reason, the IFC shall continue to allow or deny access based on the full security criteria at time of disconnection.
8. The IFC shall store on-board all the security and access parameters to operate completely independently from the central control server. Systems that rely on the central control server for access decisions will not be considered.
9. The IFC shall buffer activity data and immediately transmit it to the central control server upon re-establishment of communications.
10. Should communications fail with the ISMS, each IFC shall be capable of buffering a minimum of 1,000,000 events.
11. All events shall be time-stamped at the IFC at the time of occurrence.
12. ISMS that only time stamp the event upon receipt at the central control hardware shall not be acceptable.
13. The IFC shall be capable of storing up to a minimum of 2,000,000 card records with associated access criteria when utilizing standard DesFire EV3, Mifare, Bluetooth, Apple™ or 125KHz credentials.
14. The IFC shall support the use of six-state end-of-line circuits and enunciate whether the circuit is open, closed, alarm, trouble, open circuit tampered, or short circuit tampered as separate conditions.
15. A configurable range of end-of-line resistor values shall be supported as a software function to support pre-existing input circuits when required.
16. The IFC shall include tamper protection for the front and the back of the panel. The front panel shall be tamper protected for door open, and the rear of the

panel to detect if the panel has been removed from the wall. These shall use optical tamper detection. Mechanical tamper devices are not acceptable.

17. For software upgrades, all IFC software shall be downloaded from the central server over the network
18. The IFC shall support direct download via USB to allow local upgrade of the IFC.
    a. The upgrade process shall only accept authenticated downloads via the USB port.
19. The IFC shall operate from a DC power supply with battery backup.
20. The IFC shall continue to operate for at least 24 hours in the event of a mains supply failure.
21. The IFC shall be capable of automatically detecting and reporting a low power condition.
22. IFCs shall automatically restart and resume processing following a power failure.
23. IFCs shall be fitted with “watchdog” hardware and software to provide automatic detection and restart should the processor lock up.
24. The IFC shall contain its own real-time clock. The clock shall be synchronized with the central control server clock at least once per hour. The accuracy shall be such that the time difference between IFCs shall not vary more than 0.5 second at any time.
25. The IFC shall be allocated to a time zone appropriate to the IFC location to accommodate for regionally and globally located IFCs.
26. The IFC shall have an on-board Ethernet (TCP/IP) connection and driver supporting 10, 100 & 1000 Mbps operation. Third party plug-in RS485/Ethernet modules will not be accepted.
27. When specified, the IFC shall support
    a. Standard and single door versions - 10/100 Mbps Ethernet speed
28. The IFC shall be fitted with 2 Ethernet ports providing a fail-over communication capability.
29. The IFC shall have IPv6 address support.
30. The IFC shall support DHCP addressing.
31. The ISMS shall natively support WAN and NAT configurations to communicate with IFCs on distributed networks.

32. The IFC shall support DNS operation.
33. Should the primary DNS not be available, the IFC shall be able to automatically establish contact with a secondary or tertiary DNS.
34. The IFC shall be provided with a pre-configured IP address to allow offline initial configuration via a web browser application when required.
35. It shall be possible to view the IFC status and configuration for commissioning and diagnostic purposes without the use of the central server software or other proprietary software. This may be achieved using a conventional web browser.
36. The IFC diagnostic web interface shall not share common log on credentials with any other installed site.
37. Should excessive network broadcast traffic occur (resulting from a denial-of-service attack or similar), an alarm shall be generated.
38. The IFC shall support a high security configuration that disables unnecessary ports and legacy communication methods, this shall be achieved by an onboard jumper or DIP switch.
39. All ISMS data and communications between the central server and IFCs shall be encrypted using an industry standard encryption algorithms equivalent to Elliptical Curve Cryptography 384 combined with AES-256 or stronger.
40. Communication between the management application and IFCs shall be continuous and monitored for interruption.
41. The IFC shall support remote connectivity with the primary server via cellular or satellite back to the head end via a secured cloud connection over AWS. Should multiple cloud connected controllers exist on the same local network they will have the ability to communicate with each other peer-to-peer.
42. The IFC shall include one USB 2.0 port.
    a. There may be a USB removed version of the IFC as a derivative of the standard model
43. The IFC shall support a cellular module for alarm transmission to multiple alarm monitoring stations via a cellular network.
44. The IFC shall support logic functionality by way of configurable logic blocks.
    a. The IFC logic functionality shall be able to be run independent of the ISMS server being online.
45. The following items shall be useable as input parameters to logic blocks:
    a. physical input states

b. output states (both physical and logical)

c. door states

d. other logic block states

46. Up to ten logic block input parameters shall be configurable in AND/OR combinations to cause a logic block to operate.

47. When a logic block changes state according to the input parameters then the following types of items may change to reflect the state of the logic block:

    a. virtual output (software based)

    b. physical relay

48. The state change of the logic block shall have configurable timing options with at least the following:

    a. explicit

    b. delay on

    c. delay off

    d. pulsed

    e. maximum on time

    f. latched

49. The IFC logic block shall be able to trigger actions across multiple IFCs, independent of the ISMS server being online.

50. A separate alarm message shall be transmitted to the ISMS for at least the following alarm conditions. The alarm message shall be displayed in plain language text.

    a. tamper

    b. tamper return to normal

    c. unit stopped responding

    d. card error

    e. maintenance warning

    f. alarm sector state change

    g. user arm alarm

    h. user disarm alarm

    i. card trace

j. wrong PIN

k. access denied

l. duress

m. zone count maximum

n. zone count minimum

o. door open too long

p. forced door

q. door not locked

r. power failure,

s. system reboot

t. intercom

51. The IFC shall communicate with and control the following equipment:

    a. card access readers with PIN keypads

    b. elevator access equipment

    c. alarm monitoring input/output panels and equipment

    d. alarm monitoring input/output and IFC mounting specifically configured to match the footprint and connector placement of third party legacy field hardware.

    e. alarm response equipment

52. All communications links between the IFCs and remote devices shall be monitored such that an alarm is raised at the central control if the data being transmitted is corrupted or tampered with in any way.

53. All data communication between IFCs shall be encrypted using an industry standard symmetric encryption algorithm equivalent to AES-256 or stronger.

54. All data communication between IFCs shall use an industry standard asymmetric encryption algorithm for mutual authentication and session key negotiation. This algorithm shall be equivalent to ECC P-384 or stronger. Session keys shall be re- negotiated on a regular basis at intervals no longer than 30 hours.

55. Communication between IFCs and downstream devices shall support a high-speed serial protocol of at least 1Mbit/second.

56. The IFC shall support up to 10 high speed serial communication ports.

57. The IFC shall support up 80 devices comprising a combination of readers, I/O devices and sensors.
58. Devices connected to the high communication serial port shall contain a manufacturer's unique serial number.
59. When connected to an IFC, the serial number of the downstream device shall be reported to the ISMS.
60. Once assigned to a function within an IFC, if any attempt is made to substitute readers in the field without authorization, an alarm shall be generated.
61. The IFC shall support the Wiegand connections protocol, supporting up to 65,535 bits.
62. Wiegand formats shall be configurable, allowing for:
    a. number of bits
    b. facility/site code bits
    c. card number bits
    d. parity bit configuration
63. The IFC shall have OSDP reader support.
64. The IFC shall provide relay output facilities that are activated in response to alarm activations. Relay functions required are:
    a. Activate and latch a relay in response to an alarm. Relay to remain latched until alarm processed.
    b. Activate a relay for pre-arm "pulse" time. The relay to release after the "pulse" time lapses.
    c. Relay activation to "mirror" or "follow" the alarm input activation.
65. The ISMS shall incorporate relay outputs that can be activated according to time schedules, rather than alarm event.
66. All field hardware shall maintain a minimum of 10 years (87600 Hours).

CC. ACCESS CONTROL READERS – MULTI-TECHNOLOGY

1. The reader shall support the following technologies:
    a. Proximity 125 kHz
    b. NFC
    c. Bluetooth LE
2. The reader shall be capable of reading the CSN of the Mifare card and store

the CSN in the ISMS database

3. The readers shall support self-discovery on the ISMS.
4. Readers shall contain a manufacturer's unique serial number.
5. When connected to an IFC, the serial number of the reader shall be reported to the ISMS.
6. Once assigned to a function within an IFC, if any attempt is made to substitute readers in the field without authorization, an alarm shall be generated.
7. Data communication rate between IFCs and readers shall be at least 1Mbit/second.
8. Communication sessions between IFCs and readers shall use certificate exchange protocols using keys with a minimum strength of ECC P-256.
9. Data communication between IFCs and readers shall be encrypted and use a minimum of AES-128.
10. Readers shall generate a heartbeat signal to enable the IFC to identify lost communications and thereby generate an alarm.
11. Readers shall be upgradeable via software downloaded from the ISMS without any intervention at the reader.
12. The reader must accept a message from the IFC to advise that data from reader to IFC has been received and to consequently stop sending the card data.
13. Each reader shall be identified independently on the ISMS by means of a unique plain language descriptor. The plain language descriptor shall be at least 60 characters in length.
14. Where a card only reader is specified, the reader shall include:
    a. Integrated reader module supporting the technologies listed above.
    b. The card only reader option shall include an audible beeper and red/green LEDs to provide user feedback.
        1) A steady red LED shall indicate door secure.
        2) A flashing red LED shall indicate access denied.
        3) A steady green LED shall indicate door free access.
        4) A flashing green LED shall indicate access granted.
        5) It shall be possible to turn off the reader LED indication via the ISMS software.

c. The beeper shall give different beeps to indicate:
    1) access granted
    2) access denied
    3) second card required when dual card authorization or escort mode is programmed
    4) it shall be possible to turn off the reader beeper via the ISMS software

15. The readers must comply with at least IP68 environmental protection rating.
16. The readers must comply with an impact rating of at least IK07
17. A vandal resistant enclosure having an impact rating of at least IK08 shall be available where:
18. Vandal covers shall be fixed to the wall surface using tamper- resistant screws.
19. Vandal covers shall have beveled edges to limit the ability for persons to use the reader as an aid to climbing.
20. All external surfaces shall be beveled and without protruding parts to meet anti-ligature requirements.
21. The reader must be RoHS compliant
22. The reader shall operate with a temperature range of -30oc to +70oc.
23. Where a PIN pad is specified, the reader shall include:
    a. integrated reader module supporting the technologies listed above
    b. a minimum of a 3.5” LED color display indicating:
        1) card required
        2) PIN required
        3) access denied
        4) intrusion alarm arm
        5) intrusion alarm disarm
        6) free access
        7) second card required
24. The display shall support multiple languages which shall be selectable from the ISMS software.
25. The reader shall display information to the user using a combination of text

and graphics.

26. The reader shall display the date and time.
27. a backlit PIN pad fully integrated with the reader.
28. The PIN pad shall include:
    a. numerical 0 to 9 keys
    b. a cancel key
    c. an enter/accept key
    d. two soft keys that vary according to the current usage of the keypad
29. Menus shall be accessible by logging on with either a card or a PIN.
30. The reader shall be capable of (but not limited to) carrying out the following functions:
    a. Arm alarm zones: a minimum of 50 per reader must be supported.
    b. Disarm alarm zones; a minimum of 50 per reader must be supported.
    c. View alarms: a minimum of 100 per reader must be supported. 42.12.10.4. Acknowledge alarms; a minimum of 100 per reader must be supported.
    d. View alarm history: a minimum of 100 per reader must be supported.
    e. Change the door to free access mode. 42.12.10.7. Change the door to secure access mode.
    f. Change the door to operate from a user defined schedule.
    g. Turn outputs on and off; a minimum of 50 per reader must be supported.
    h. View the status of inputs; a minimum of 100 per reader must be supported.
    i. Isolate inputs: a minimum of 100 per reader must be supported.
31. User definable custom images shall be displayed on the screen when the reader is idle.
32. The reader shall support the following image formats:
    a. PNG
    b. JPG
    c. JPEG
33. It shall be possible to adjust the reader beeper via the ISMS software to the following volume levels:

a. off

b. quiet

c. normal

d. loud

34. The reader shall have the ability to display the status of alarms and indicate the status of physical and logical items via LEDs on front panel.

35. The reader shall support at least 8 indication LEDs.

36. It shall be possible to turn off the reader indicator LEDs via the ISMS software.

37. Tamper detection shall be provided against the unit being removed from the mounting surface.

38. Keypad readers must comply with a minimum IP66 environmental protection rating.

39. Keypad readers must comply with an impact rating of at least IK08.

40. The keypad reader shall operate with a temperature range of -30oc to +70oc.

41. All readers must be RoHS compliant.

42. The keypad reader shall support a backlight feature for dark environments.

DD. ACCESS CONTROL READERS – BLUETOOTH AND NFC

1. The system shall have the capability to use a mobile device as an access credential in place of a traditional access control card.

2. Connectivity between the mobile device and access control reader shall be via BLE communication or NFC technology (subject to the capability of the mobile device).

3. In addition to BLE and NFC support, the access control reader must support multiple card and communication technologies to allow for scenarios where a mobile device may not be available. The reader shall support the following:

   a. Proximity 125 kHz

4. Any communication between the ISMS and a cloud server shall be limited to those initiated by outbound requests from the ISMS only to ensure system security.

5. It shall be possible to configure the Bluetooth functionality of the reader via the ISMS.

6. The options for configuration shall include:

a. enable/disable reader BLE functionality
b. enable/disable second factor authentication whereby the user must present their mobile device and enter a PIN.
c. enable/disable the ability of the reader to advertise its name via BLE
d. adjust the overall transmit power of the reader
e. enable/disable the ability for the mobile device to automatically connect to the access control reader
f. adjust the signal strength threshold for auto connection to the access control reader
g. enable/disable the ability for the mobile device to manually connect to the access control reader
h. adjust the read range for manual connection to the access control reader

7. Arm all zones (globally).
8. Arm individual zones.
9. It shall be possible to configure and calibrate the BLE functionality of the reader via an application on the mobile device. The configuration and calibration options shall include:
    a. enable/disable reader BLE functionality
    b. enable/disable second factor authentication whereby the user must present their mobile device and enter a PIN.
    c. enable/disable the ability of the reader to advertise its name via BLE
    d. adjust the overall transmit power of the reader
    e. enable/disable the ability for the mobile device to automatically connect to the access control reader
    f. adjust the signal strength threshold for auto connection to the access control reader by placing the mobile device at the distance where it is required to operate and selecting a calibration button
    g. enable/disable the ability for the mobile device to manually connect to the access control reader
    h. adjust the read range for manual connection to the access control reader by placing the mobile device at the distance where it is required to operate and selecting a calibration button.
10. Provisioning of a mobile device to be used as an access credential shall be

carried out within the ISMS core software. Obtaining credential details via a third-party application or web site will not be acceptable.

11. Provisioning of the access credential shall be a two-step process to ensure security.
    a. An email shall be sent to the user who will confirm acceptance of the access credential on their mobile device.
    b. After acceptance, a confirmation code of no less than 6 digits shall be sent via SMS to the mobile device, whereby the user will enter this into the mobile device access control application to enable its operation.
12. The time allowed for the credential to be accepted shall be configurable within the ISMS. After the time has expired, the credential will need to be re-issued.
13. Systems that use a single step provisioning process are not acceptable. This is to avoid instances where the ISMS operator incorrectly enters an email address or mobile device number and an incorrect person receives the access credential.
14. It shall be possible to remove authorization of access credentials via the ISMS should a mobile device be lost.
15. It shall be possible to re-issue access credentials via the ISMS should a mobile device be replaced.
16. It shall be possible to re-issue access credentials to another cardholder.
17. When the mobile device is presented to the reader, the access decision shall be made at the IFC. Systems where the access decision is made at the ISMS server or in the cloud are not acceptable.
18. In addition to using the mobile device as an access control credential, the following functionality shall be available via the mobile device access control application:
    a. arm and disarm an alarm zone
    b. change the mode of a door from secure to free access, and vice versa
    c. change the scheduled access mode of a door
    d. activate/deactivate relay outputs anywhere on the system. The relays do not necessarily have to be connected to the access controller which is connected to the Bluetooth reader
    e. receive messages from the ISMS via push notifications
19. ISMS shall support Bluetooth Tag tracking utilizing Bluetooth Low Energy specification outline for ibeacon and Eddystone.

EE.RS485 FIBER OPTIC TRANSCEIVER REQUIREMENTS

1. The fiber transceiver shall provide two independent data channels operating as either multi-mode or single-mode devices (depending on the model).
2. Each channel will be capable of transparently supporting data speeds of 1MB/S on a single fiber.
3. Each data channel will be capable of handling 2-wire half-duplex RS485 data as per the TIA/EIA standards.
4. The multi-mode fiber transceiver shall be capable of supporting distances up to 4km between fiber transceivers.
5. The single-mode fiber transceiver shall be capable of supporting distances up to 40km between fiber transceivers.
6. Up to 60 devices per RS485 channel shall be supported.
7. The fiber transceiver shall support the following network topologies:
    a. point-to-point
    b. multi-drop
    c. redundant self-healing ring topology
8. The fiber transceiver will provide indication of port faults and network damage which shall support the following:
    a. LED indication at the unit
    b. relay output at the unit
    c. configurable to indicate either local or global (all transceivers) faults
9. LED indicators on the fiber transceiver shall indicate the following:
    a. data activity
    b. Synchronization status
    c. fault status
    d. fault location
10. Each channel shall support individually selectable RS485 biasing via a dipswitch.
11. The operating temperature for the fiber transceiver will be -40^{o}C to +75^{o}C.
12. The fiber transceiver shall have reverse polarity protection.
13. Mean time between failure for the fiber transceiver should be no less than

100,000 hours.

PART 3 EXECUTION

3.01 INSTALLERS

A. Contractor installation personnel shall be factory trained and certified by the ISMS manufacturer and have a valid, current certification at the time of installation.

B. Contractor installation personnel shall comply with all applicable state and local licensing requirements.

3.02 PREPERATION

C. The network design and configuration shall be verified for compatibility and performance with the ISMS.

D. The network configuration shall be tested and qualified by the Contractor prior to system installation.

E. Server performance parameters shall be compared with Manufacturer requirements for the ISMS.

3.03 INSTALLATION

F. Contractor shall follow manufacturer published installation and configuration instructions and guidelines.

G. System shall be configured in accordance with manufacturer-supplied hardening guide. ISMS systems for which the manufacturer does not provide a hardening guide shall not be acceptable.

3.04 STORAGE

H. Server and system hardware devices and components shall be stored in an environment where temperature and humidity are in the range specified by the Manufacturer.

END OF SECTION 28 13 00

SECTION 28 31 00 - ADDRESSABLE VOICE-EVAC TYPE FIRE ALARM SYSTEM

1. GENERAL

A. SCOPE AND RELATED DOCUMENTS

(1) The work covered by and the intent of this section of the specifications includes the furnishing of all labor, equipment, materials, testing, programming and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings, as herein specified and as required by the applicable codes.

(2) The requirements of all other applicable conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.

(3) The complete installation shall conform to the applicable sections of NFPA-71, NFPA-72A, B, C, D, Local Code Requirements and National Electrical Code (Article 760). The requirements of any local fire department and the Authority Having Jurisdiction shall also be observed in the system installation and device layout.

(4) The work included in this section shall be coordinated with related work specified elsewhere in these specifications.

B. QUALITY ASSURANCE

(1) Every component, device, transmitter, software, etc., that are included in the work, to make up a complete Fire Alarm System shall be listed as a product by the manufacturer under the appropriate category by the Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label.

(2) The system power, signal and controls wiring shall be UL listed for Power Limited Applications per NEC 760. All circuits shall be marked in accordance with NEC Article 760.

C. GENERAL

(1) Furnish and install a complete digital multiplex Addressable Voice Evacuation type Fire Alarm System as described herein and as shown on the plans; to be wired, connected, completely tested, and left in first class operating condition. The system shall use individually-addressable digital multiplex device circuit(s) with individual device supervision, appliance circuit supervision, and incoming normal and stand-by power supervision. In general, systems shall include a control panel, manual pull stations, automatic fire detectors, speakers (in quantity required to meet intelligibility requirements), flashing lights, annunciator, local operator console, two-way communication station(s), interconnection to existing elevator equipment, raceways, all wiring, connections to devices, connections to valve tamper switches, water flow switches and mechanical controls, outlet boxes, junction boxes, and all other necessary

materials for a complete, operating system. Reconnect to existing system device locations accordingly. Provide new devices accordingly if tie-in to existing manufacturer/system is not possible.

The fire alarm control panel shall allow for loading or editing of any special instructions or operating sequences as required. No special tools, modems, or an off-board programmer shall be required to program the system to facilitate future system expansion, building parameter changes, or changes as required by local codes. All instructions shall be stored in a resident non-volatile programmable memory.

(2) All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name of each component. Any catalog numbers specified under this section are intended only to identify the type, quality of design, materials, and operating features desired.

(3) Equipment for shop drawing review must include a minimum of the following:

a. Complete descriptive data indicating UL listing for all system components.

b. Complete sequence of operations of the system.

c. Complete system wiring diagrams for components capable of being connected to the system and interfaces to equipment supplied by others.

d. A copy of any state or local Fire Alarm System equipment approvals.

e. An AutoCAD (latest version) produced wiring diagram illustrating the basic floor plan of the building, showing all system wiring and equipment, as well as zoning boundaries and schedule of zone legends as intended to appear on annunciators. Provide three hard copies (on an external memory drive, or other method approved by the engineer) of as-built drawings and all system operational software, training videos, submittals, etc. at close of project, to be included in operation and maintenance manuals.

(4) No work shall be done until the drawings are approved by the local authority having jurisdiction.

D. APPLICABLE STANDARDS AND SPECIFICATIONS

(1) The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

(2) National Fire Protection Association (NFPA) – USA

No. 12 Extinguishing Systems (low and high)
No. 13 Sprinkler Systems
No. 70 National Electric Code

No. 90A Air Conditioning Systems
No. 72 National Fire Alarm Code
No. 101 Life Safety Code

(3) Underwriters Laboratories Inc. (UL) – USA

No. 268 Smoke Detectors for Fire Protective Signaling Systems
No. 864 Control Units for Fire Protective Signaling Systems
No. 217 Smoke Detectors, Single and Multiple Station
No. 228 Door Closers - Holders for Fire Protective Signaling Systems
No. 268A Smoke Detectors for Duct Applications
No. 521 Heat Detectors for Fire Protective Signaling Systems
No. 464 Audible Signaling Appliances
No. 38 Manually Actuated Signaling Boxes
No. 1481 Power Supplies for Fire Protective Signaling Systems
No. 346 Waterflow Indicators for Fire Protective Signaling Systems
No. 1076 Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971 Visual Notification Appliances
No. 2017 Standard for General-Purpose Signaling Devices and Systems

(4) Local and State Building Codes.

(5) Latest Adopted Edition of the International Building Code

(6) Latest Adopted Edition of the International Fire Code

(7) All requirements of the Authority Having Jurisdiction (AHJ)

E. OPERATION

(1) The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch shall be as follows:

a. 1) The appropriate initiating device circuit indicator (red color) shall flash on the control panel until the alarm has been silenced at the control panel. Once silenced, this same indicator shall latch on. A subsequent alarm received after silencing shall flash the subsequent zone alarm indicator on the control panel and resound alarms and flashing signals. These same conditions shall occur at any remote annunciator.

2) A pulsing alarm tone shall occur within the control panel until silenced.

b. All alarm indicating appliances shall sound in a temporal code pattern until silenced by an alarm silence switch at the control panel (or the remote annunciator, if any).

c. All doors normally held open by door control devices shall close. Doors shall also be released in the event of incoming normal power failure.

d. A supervised signal to notify the local fire department or an approved central station (as required by local codes) shall be activated.

e. A supervised signal shall directly activate, shut down or reconfigure the air handling systems as required by NFPA or as otherwise indicated herein. Provide necessary interlock wiring as required to control mechanical equipment.

f. The Contractor(s) shall coordinate with each other as necessary to provide all required auxiliary contacts, DDC systems interfaces, equipment, etc., as needed to shut down or otherwise control air handling systems per NFPA and all applicable codes.

g. The system shall be wired with two circuits to all Notification devices so that when an alarm is acknowledged, silencing the audibles, the visual units shall continue in operation until the main control panel has been reset. If local codes require other than this arrangement, the system shall be wired in accordance with the code that is applicable.

h. The system shall be configured to shunt all communication systems (i.e. paging systems, etc.) present in the building served to allow for proper annunciation of the fire alarm system per code requirements. This contractor shall be responsible for providing all necessary interconnections to public address or similar systems, including coordination with manufacturers for the proper deactivation of building systems during a fire event.

(2) The alarm indicating appliances shall be capable of being silenced only by authorized personnel operating the alarm silence switch at the main control panel or by use of a similar key operated switch at the remote annunciator or local operator console (where remote units are provided). A subsequent alarm shall reactivate the signals. Operation of the alarm silence switch shall be indicated by trouble light and audible signal.

(3) The alarm activation of any elevator lobby shaft, pit or equipment room smoke detector shall, in addition to the operations listed above, cause the elevator cabs to be recalled according to the following sequence:

a. If the alarmed detector is in any location or on any floor other than the main level of egress, the elevator cars shall be recalled to the main level of egress. Coordinate the integration of elevator recall functionality with existing elevator cabs/controllers with the elevator manufacturer.

b. If the alarmed detector is on the main egress level elevator lobby, the elevator cabs shall be recalled to the pre-determined alternate recall level. Alternate recall level shall be confirmed in the field by the AHJ.

c. Provide auxiliary contacts within the base of each elevator lobby smoke detector, with each separate landing to be wired back separately to the elevator controller. Coordinate all equipment terminations and sequence of operation with the elevator

installer. The use of digital to analog controllers to accomplish this function will be acceptable, if in compliance with codes.

d. Provide heat detectors within 12" of each sprinkler head where they are installed in elevator equipment rooms, shafts or pits, in accordance with code. The temperature rating and wiring of the detectors shall be coordinated with the sprinklers, per ANSI Elevator Code and NFPA. Wire to interrupt elevator power per the applicable code.

(4) The activation of any standpipe water valve tamper switch or sprinkler zone valve tamper switch shall activate a distinctive system supervisory audible signal and illuminate a "Sprinkler Supervisory Tamper Switch" indicator at the system controls (and the remote annunciator[s]). There shall be a distinction in the audible trouble signals between valve tamper switch activation and opens or grounds on fire alarm circuit wiring.

a. Activating the trouble silence switch will silence the supervisory audible signal while maintaining the "Sprinkler Supervisory Tamper" indicator showing the tamper contact is still activated.

b. Restoring the valve to the normal position shall cause the audible signal and visual indicator to pulse at a fixed rate.

c. Activating the trouble silence switch shall silence the supervisory audible signal and restore the system to normal.

(5) Include with the control panel, as an auxiliary function, a built-in test (“drill”) mode that, when activated, will cause the following operation sequence:

a. The city connection circuit shall be disconnected.

b. Control relay functions shall be bypassed.

c. The control panel shall show a trouble condition.

d. The panel shall automatically reset itself.
e. Any momentary opening of an initiating or indicating appliance circuit shall cause the audible signals to sound for a minimum of two seconds to indicate the trouble condition.

(6) A manual evacuation switch shall be provided to operate the system indicating appliances and/or initiate "Drill" procedures.

(7) Activation of an auxiliary bypass switch shall override the automatic functions either selectively or throughout the system and initiate a trouble condition at the control panel.

(8) Include any and all detection equipment and interface relays as required to provide a 100% code approved and supervised pre-action Fire Suppression system. Coordinate with the Fire Protection installer as required.

(9) System Reset, Test & Print Status:

a. Selection of the System Reset shall cause all electronically latched initiating devices to return to their normal condition. Initiating devices shall re-report if active. Active notification appliance circuits shall not silence upon Reset. Systems that de-activate and subsequently re-activate notification appliance circuits shall not be considered equal. All programmed Control-By-Event equations shall be re-evaluated after the reset sequence is complete if the initiating condition has cleared. Non-latching trouble conditions shall not clear and re-report upon reset.

b. Lamp Test: The lamp test shall activate all local system LEDs, light each segment of the display and display the panel software revision for the service personnel.

c. Scroll Display Keys: There shall be Scroll Display keys for FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE and OTHER EVENTS. Depression of the Scroll Display key shall display the next event in the selected queye allowing the operator to view events by type.

d. Print Screen: Depression of the PRINT SCREEN switch shall send the information currently displayed on the touchscreen LED.

F. SUPERVISION

(1) The system shall contain Class "B" (Style "B") independently supervised initiation circuits as required for the zoning indicated. Circuits shall be arranged so that a fault in any one zone shall not affect any other zone. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.

(2) There shall be supervisory initiation circuit(s), as required, for connection of all sprinkler valve tamper switches. Wiring methods which require any fire alarm initiation circuits to perform this function shall be deemed unacceptable, i.e., sprinkler and standpipe tamper switches (N/C contacts) shall NOT be connected to circuits with fire alarm initiation devices (N/O contacts). These independent initiation circuit(s) shall each be labeled "Sprinkler Supervisory Tamper Switch" and shall differentiate between tamper switch activation and wiring faults. Provide individual annunciation for the main post indicator valve and each tamper switch as indicated by the zoning schedule on the plans or as otherwise required by codes. For these circuits and all exterior underground copper circuit wiring, provide proper surge suppression and protection for circuit.

(3) There shall be independently supervised and independently fused indicating appliance circuits as required for alarm audible signals and flashing alarm lamps.

(4) All auxiliary manual controls shall be supervised so that all switches must be returned to the normal (automatic) position to clear system trouble.

(5) Each independently supervised circuit shall include a discrete (amber color) "Trouble" indicator to indicate disarrangement conditions, per each circuit.

(6) The incoming power to the system shall be supervised so that any power failure shall be audibly and visually indicated at the control panel and the annunciator. A green color "power on" indicator shall be displayed continuously while incoming power is present.

(7) The system batteries shall be lead-acid type, supervised so that disconnection or failure of a battery shall be audibly and visually indicated at the control panel (and the annunciator).

(8) Wiring to a remote annunciator (if provided for system) shall be supervised for open and ground conditions. An independent annunciator trouble indicator shall be activated, and an audible trouble signal shall sound at the control panel.

G. POWER REQUIREMENTS

(1) The control panel shall receive 120 VAC power via a dedicated circuit. The incoming circuit shall have suitable overcurrent protection within the control panel, as well as at the circuit source. If additional circuits are required for this or other control units, they shall be provided by the Contractor.

(2) If the facility is equipped with an emergency standby power generator, the fire alarm equipment shall be connected to this system, per N.E.C.

(3) The system control panel and auxiliary equipment, such as power supplies, shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of no less than 36 hours, or as required by codes for the building occupancy. There shall be reserve battery capacity to drive all alarm appliances for five-minute indication at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operating shall be automatic. Batteries, once discharged, shall recharge at a rate that will provide a minimum of 70% capacity in 12 hours, or sooner if required by codes.

(4) All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.

(5) Power supplies for Notification signals, whether in the main panel or within remote power supply cabinets, shall be designed to provide a minimum of 20% spare capacity for future signals.

2. PRODUCTS

A. MANUFACTURERS
   (1) Basis of Design Product: Subject to compliance with requirements, provide product indicated on drawings as manufactured by Honeywell systems.
      a. Base-bid for fire alarm systems shall be NOTIFIER Addressable Fire Alarm System, a Honeywell product. No other alternate products or manufacturers shall be acceptable for base-bid pricing.
      b. The alternate-bid for fire alarm systems shall allow the following manufacturers:
         1) Edge Series Addressable Fire Alarm Systems, An Edwards Fire Systems Brand
         2) Cerberus UL Addressable Fire Alarm Systems, A Siemens Brand
         3) Other alternate manufacturers, as approved by the engineer and the owner.

B. EQUIPMENT AND MATERIAL, GENERAL REQUIREMENTS
   (1) All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system. The materials, equipment, and devices shall be tested to function with manufactures approved FACP via a cloud base life safety services system.

   (2) The system shall fully comply with commissioning and test and inspect reports as outline in NFPA-72. System test shall automatically retrieve the fire systems connected devices utilizing a gateway. In applications where a gateway is not applicable the systems peripheral devices shall be entered manually and/or by using barcodes.

   (3) All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.

   (4) All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

C. CONDUIT AND WIRE, GENERAL REQUIREMENTS
   (1) Conduit

      a. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements, where applicable.

b. Where required by NEC and local codes, all wiring shall be installed in conduit or raceway. Where not required by code, it shall be acceptable for new fire alarm system wiring to be installed above ceiling and supported per NEC requirements, outside of conduit.
   1) Conduit fill shall not exceed 40 percent of interior cross-sectional area where three or more cables are contained within a single conduit. Where not code-required, fire alarm cabling shall be allowed to be installed in low-voltage cable raceways, as allowable by code.
   2) Cable raceways for fire alarm systems shall be dedicated to the fire alarm system, and shall not be shared with other systems.

c. The system cabling must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760.

d. Wiring for 24-volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit, raceway or manner as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

e. Conduit/raceways shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.

f. Conduit shall be 3/4-inch (19.1 mm) minimum, where applicable.

(2) System Wiring

a. All fire alarm system wiring must be new, installed in new above ceiling support structures/raceways, per specifications, unless otherwise noted.

b. All newly installed fire alarm system wiring shall be plenum rated (e.g. FPLP, FPLR).

c. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits, signaling line circuits, and notification appliance circuits.

d. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

e. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

f. The system shall permit the use of IDC and NAC wiring in the same conduit/raceway with the multiplex communication loop.

g. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

h. All analog voice speaker and analog telephone circuits shall use twisted/shielded pair to eliminate cross talk.

(3) Terminal Boxes, Junction Boxes

a. All boxes and cabinets shall be UL listed for their intended purpose.

(4) Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

(5) The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG, installed in minimum trade size ¾" EMT. The control panel cabinet shall be grounded securely to either a cold-water pipe or grounding rod.

D. FIRE ALARM CONTROL PANEL

(1) Where shown on the plans, provide and install the Fire Alarm Control Panel (FACP). Construction shall be modular with solid state, microprocessor-based electronics. All visual indicators shall be high contrast, light-emitting diode type. The FACP shall be a single, scalable hardware platform without the need to replace the CPU for future system expansion. The CPU shall communicate with and control the following types of equipment that make up the fire alarm system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, control circuits, notification appliance circuits, local and remote operator consoles/terminals, printers, annunciators, and other system control devices.

(2) The control panel shall contain the minimum following features as per plans:

- Minimum Capacity of 120 Control or Monitor Points or greater, to Suit Building Requirements, expandable to 1000 points
- Initiation Device Circuits
- Alarm Indicating Appliance Circuit
- Supervised Annunciator Circuits
- Local Energy City Connection, if required
- Form C Alarm Contacts (2.0 Amps ea., minimum of two unless otherwise required)
- Earth Ground Supervision Circuit
- Automatic Battery Charger, of proper rating
- Standby Battery, Lead/Acid Type. Provide integral battery box for FACP, sized as required for all necessary system batteries at listed capacity.
- Resident non-volatile programmable operating system for all operating requirements
- Supervised Manual Evacuation Switch
- Internal power supplies as required for auxiliary functions as indicated
- Auxiliary contacts or relays for auxiliary functions as indicated
- All Custom Software and Programming as required to suit the project requirements

(3) The control panel shall be provided with a digital alarm communication transmitter, with the following requirements:

a. Communication via cellular shall be included by utilizing AT&T or Verizon communication services. Additional Cellular carriers shall be acceptable only at

the formal confirmation by the owner. Cell communication shall be per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events.

b. The contractor shall engage an Emergency 24/7 service provider who is currently providing fire alarm monitoring services to the owner's facilities, and shall include (2) years of their monitoring costs in their contract. If no current provider information is available for the facility, the Contractor shall engage a local Emergency 24/7 provider, and provide verification that the provider can meet the response requirements, as dictated by code and system performance requirements. Final Emergency 24/7 service provider shall be confirmed with the owner at time of system provision.

c. The CLSS Gateway (or similar device/protocol, system manufacturer, dependent) shall be completely field programmable utilizing the CLSS mobile app.

d. Communication shall include vital system status such as:
   1) Independent Zone (Alarm, trouble, non-alarm, supervisory)
   2) Independent Addressable Device Status
   3) AC (Mains) Power Loss
   4) Low Battery and Earth Fault
   5) System Off Normal
   6) 12- and 24-Hour Test Signal
   7) Abnormal Test Signal (per UL requirements)
   8) EIA-485 Communications Failure
   9) Phone Line Failure

e. It shall support independent zone/point reporting when used in the Contact ID format. In this format the communicator shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

(4) The FACP shall be based on a licensing model to allow for future system expansion. Licensable features shall include, but not be limited to: additional general zones, logic zones, CLIP mode support and network display support. The FACP shall be backwards compatible to support previous device and software versions.

(5) The FACP shall be fully networkable to support both standard and high-speed networks.

(6) The FACP shall include the capability to function as a network control display, along with its main functions.

(7) FACP System Capacity & General Operations

a. The control panel shall be scalable up to 10 SLC modules without the need of replacing the CPU. Each SLC module shall support a maximum of 318 analog/addressable devices for a system capacity of 3180 points. The system shall be capable of up to 4500 annunciation points per system regardless of the number of addressable devices.

b. The Fire Alarm Control Panel shall include a full featured 10 inch 1024x600 resolution LCD with touch capability, including audible and visible feedback, backlit by a long life, solid-state LCD. It shall also include a full QWERTY-style keypad on the color, touchscreen display. The display shall have the ability to scroll events by type (i.e. Fire Alarm, Supervisory Alarm, Trouble, etc) using the touchscreen.

c. The touchscreen LCD shall be intuitive and allow for custom configuration of actional events to be program as a selectable icon on the screen.

d. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.

e. The FACP shall be able to provide the following software and hardware features:

1) Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

2) Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.

3) Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.

4) Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.

5) The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
6) Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.

7) NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meet the requirements of NFPA 72.

8) Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.

9) On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop.

10) History Events: The panel shall be capable of maintaining a history file up to the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain up to a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000-event history file.

11) The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.

12) Drill: The system shall support means to activate all silenceable fire output circuits in the event of a practice evacuation or "drill". If enabled for local control, the front panel switch shall be held for a minimum of 2 seconds prior to activating the drill function.

13) Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.

14) Two Wire Detection: The system shall support standard two-wire detection devices specifically from the following manufacture; System Sensor.

15) Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions

16) Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.

17) Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.

18) Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.

19) Print Functions: The system shall provide means to obtain a variety of reports listing all event, alarm, trouble, supervisory, or security history. Additional reports shall be available for point activation for the last Walk Test performed, detector maintenance report containing the detector maintenance status of each installed addressable detector, all network parameters, all panel settings including broad cast time, event ordering, and block acknowledge, panel timer values for Auto Silence, Silence Inhibit, AC Fail Delay time and if enabled, Proprietary Reminder, and Remote Reminder timers, supervision settings for power supply and printers, all programmed logic equations, all custom action messages, all non-fire and output activations (if pre-programmed for logging) all active points filtered by alarms only, troubles only, supervisory alarms, prealarms, disabled points and activated points, all installed points filtered by SLC points, logic zones, annunciators, releasing zones, special zones, and trouble zones.

20) Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.

21) Resound based on type for security or supervisory: The system shall indicate a Security alarm when a monitor module point programmed with a security Type Code activates. If silenced alarms exist, a Security alarm will Resound the panel sounder. The system shall indicate a Supervisory alarm when a monitor module point programmed with a supervisory Type Code activates. If there are silenced alarms, a Supervisory alarm will Resound the panel sounder.

22) Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.

23) Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.

24) Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector to up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result or product of all cooperating detectors chamber readings.

25) Tracking/Latching Duct (ion and photo): The system shall support both tracking and latching duct detectors either ion or photo types.

26) One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

(8) Enclosures

a. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

b. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.

c. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.

d. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

e. The FACP shall have a modular dress panel and door design with interchangeable door hinge locations.

(9) CLSS Checkpoint Hub/Gateway

a. Provide a CheckPoint gateway for connection to a the fire system panel, serving as an interface between the FACP, Cloud and peripheral devices. The CheckPoint Hub shall be capable of reading the connected device system data

base from a single or network of panels and shall transmit the data to the Connected Life Safety Services (CLSS) cloud.

b. Equipment standard features shall allow Blue Tooth mobile paring for gateway configuration and control capability.

c. Connection to fire system panels utilizing Universal Protocol Ports via RJ45.

d. Provide Nominal Voltage consumption of 12V to 32V DC from the FACP or an external power supply.

e. The CLSS gateway shall allow for alarm transmission to a central station via IP and or GSM.

f. The system shall support the ability for installation and or test and inspection personnel to generate automated commissioning reports or test and inspection reports via the Connected Life Safety Service (CLSS) platform enabling reports to be provided to the appropriate stakeholders immediately after completion of the system commission or test and inspection.

g. The CLSS platform shall support the ability to automatically capture every addressable device connected to the system ensuring that each addressable device is accounted for and properly tested. CLSS shall also support importing any non addressable devices associated with the system to ensure all system devices are accounted for and properly tested.

h. For self-testing devices CLSS shall identify any issues associated the integrity of the ability for the smoke detector to properly detect smoke such as a dust cap not being removed or someone tampering with the detector by obstructing the smoke detector chamber.

E. SYSTEM SOFTWARE AND PROGRAMMING

(1) Provide all programming and software necessary to place annunciators and controls in full operation. System set-up shall allow for changes in annunciator legends without rewiring or addition of programming or electronics. Furnish initial programming and reprogramming as needed to accommodate changes in the system up to the time of system acceptance by the engineer without extra charge.

F. REMOTE ANNUNCIATOR

(1) Where indicated on the plans, provide and install annunciator/control panel. The panel shall be of vandal-resistant construction and shall contain a liquid crystal illuminated display for alphanumeric indication of all required functions. The panel shall also contain the following control functions, activated by a master system enable key switch on front panel:

a. Remote system reset switch, to complement main control panel reset switch.

b. Remote alarm signal silence switch.

c. Remote manual evacuation switch, to initiate fire drill functions, same as at main control panel.

d. Remote trouble silence switch to silence trouble alarms in annunciator panel and main control panel.

e. Install panel on properly sized outlet box, 54" AFF to centerline. Panel shall contain tamper-resistant LED test switch in panel, local audible alarm, system power on, trouble LED indicators and master system enable key switch, keyed alike with the main control panel.

(2) Annunciator legends shall be custom, to display both zone number and brief legend indicating the area or device associated with that zone. The legends shall be electronically generated on an alphanumeric display panel. The fire alarm system vendor shall coordinate the legends with the Engineer at shop drawing review.

(3) Wiring between the main control panel and annunciator(s) shall be fully supervised, and accomplished over twisted shielded pair and/or THWN wiring as required by the manufacturer, per N.E.C. and NFPA.

G. PERIPHERAL DEVICES

Note: On fully digital multiplex systems, provide addressable devices, bases or modules for devices listed herein. Each device shall be an individual address on the system. Addressable bases or modules shall be U.L. listed for the device served.

(1) MANUAL PULL STATION

a. Manual stations shall be <u>double action</u> and shall be constructed of high impact, red lexan or cast metal with raised white lettering and a smooth high gloss finish. The manual pull station shall have a hinged front with key lock. Stations shall be keyed alike with the fire alarm control panel. When the station is operated, the handle shall lock open in a protruding manner. Furnish one key for each manual station to owner at close of project, during instruction period. Install within 60" of each exit, per code, whether indicated on the drawings or not. Confirm final quantities and locations of manual pull stations with the AHJ prior to construction and provide in accordance with AHJ requirements.

(2) CEILING-MOUNTED SMOKE DETECTORS, PHOTOELECTRIC TYPE

a. Furnish and install where indicated on the plans or required, ceiling-mounted smoke detectors. Provide separate outlet-box mounted base with auxiliary relay, or standard base, as required.

b. Smoke Detectors shall be listed to U.L. Standard 268 and shall be compatible with their control equipment. Detectors shall be listed for this purpose by Underwriters' Laboratories, Inc. The detectors shall obtain their operating power from the fire alarm panel supervised detection loop. Loss of the operating voltage shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal to be generated at the control panel. Detectors shall be capable of being reset at the main control panel.

c. No radioactive materials shall be used. Detector construction shall provide mounting base with twist-lock detector head. Contacts between the base and head shall be of the bifurcated type using spring-type, self-cleaning contacts. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel. Detector design shall provide full solid state construction, and compatibility with other normally open fire alarm detection loop devices such as heat detectors, pull stations, etc.

d. To minimize nuisance alarms, voltage and RF transient problems, suppression techniques shall be employed as well as a smoke verification circuit and an insect screen. The detector head shall be easily disassembled to facilitate cleaning.

e. Remote LED alarm indicators shall be installed where required.

f. Smoke detectors (and all other system electronics) shall be shielded to protect circuitry from EMI problems generated by power fields, cellular phones, etc.

g. Special Note: The Contractor installing smoke detectors shall use care in the final positioning of all devices. They shall not be installed closer than 36" from an air diffuser or return grille, closer than 24" from a ceiling/wall intersection, or similar location that would diminish detector performance. Refer to and comply with NFPA 72E, "Standard On Automatic Fire Detectors".

h. Provide smoke detector at each fire alarm system control component, as required by code.

(3) AUTOMATIC HEAT DETECTORS (RATE-OF-RISE TYPE)

a. Automatic heat detectors shall be combination rate-of-rise and fixed-temperature type. When the fixed-temperature portion is activated, the units shall be non-restorable and give visual evidence of such operation. Heat detectors shall be 135, 165 or 195NF, as indicated on plan. Where not indicated, provide 165º F units. Provide as indicated or required.

(4) AUTOMATIC HEAT DETECTORS (FIXED TEMPERATURE TYPE)

a. Where indicated on the plans, provide automatic heat detectors of the non-restorable type, of the temperature rating as indicated or required. Detector heads

shall be mounted to an outlet-box mounted base. Provide auxiliary contacts as needed. Provide as indicated or required.

(5) AUDIBLE AND VISUAL UNITS

a. Audible signals shall be polarized and shall be operated by 24 VDC. Each audible assembly shall include separate wire leads for in/out wiring for each leg of the associated signal circuit. T-tapping of signal device conductors to signal circuit conductors will not be accepted. The audible visual units shall be equipped with a xenon-type strobe which shall be semi-flush mounted on 4" square outlet box. Each audible device shall produce a minimum sound pressure level of 92db at 36" on axis. Provide units as manufactured by Wheelock, Inc., or approved equivalent. Locate as indicated or required. All audible tones for same function shall be identical, per NFPA. Provide sufficient audible units to comply with code for required coverage. Provide temporal coded signals.

b. The output intensity of all visual units, their locations and mountings shall be in compliance with the latest version of the Americans with Disabilities Act requirements.

c. Audible units and visual units shall be wired to separate Notification circuits, allowing for silencing of audibles with alarm acknowledgment, continuing operation of strobes until system reset. Addressable devices may be used to fulfill this requirement.

d. Provide system-wide synchronization of all visual devices, so that all strobes flash at the same rate and at the same time, complying with A.D.A.

(6) VISUAL UNITS

a. Stand-alone visual indicating units shall be xenon type strobe matching audio-visual units. These devices shall be UL listed and be or wall mounted. A high-impact clear lens shall project out from backplate. Lettering, if any, shall be oriented upright to the standing viewer. Candela output values of all visual units shall be selected for the covered spaces geometry and size, complying with A.D.A. and NFPA.

(7) DOOR HOLDERS

a. Magnetic door holders shall be 24 volt A.C., and shall have an approximate holding force of 25 lbs or greater, if required to restrain door. The door-mounted portion shall have a plated steel pivot mounted armature with shock absorbing bearing. Unit shall be capable of being either surface, flush, semi-flush or floor mounted as required. Door holders shall be UL listed for their intended purpose. Where door mounted, locate armature 6" down from top and 6" in from strike side of leaf. Where door swing prevents direct contact between armature and holder pole piece, provide non-removable plated chain to close gap as tightly as possible. Verify holder positioning with Architect prior to mounting any devices. Unless otherwise indicated, provide semi-flush mounted holders 6" below top of door leaf as noted above, with

blocking in wall to support force of door impact against holder and outlet box. Provide at all needed locations as indicated or required. Coordinate with architectural hardware schedule, as applicable to project.

(8) DUCT SMOKE DETECTORS

a. Duct smoke detectors shall be of the solid state photoelectric type, operating on the light scattering photodiode principle. The detectors shall ignore invisible airborne particles or smoke densities that are below the set alarm point. No radioactive materials shall be used. The basic construction of duct smoke detectors shall be the same as that previously described for ceiling-mounted smoke detectors. Duct housing couplings shall be slotted to insure proper alignment of the sampling and exhaust tubes. Detector shall have an alarm status LED visible through a transparent cover, panel or in housing.

b. The Contractor shall furnish air duct smoke detectors with template to the sheetmetal or air handling unit installer for installation. Coordinate length of sampling probe required and furnish appropriate length. Probe tube shall be located in accord with manufacturer's recommendations, to give maximum sampling rate of airflow. Provide multiple detectors, as required, if a single device will not provide adequate sensing due to duct size or air velocity. Wire multiple detectors on a single air handling system as a single zone or address unless otherwise required by prevailing codes. Field verify quantity of detectors needed to provide NFPA-compliant coverage of the air handling unit and provide as required.

c. Detector supervised power and alarm wiring (from F.A. control panel) is to be provided by the Contractor. Interlock wiring from auxiliary contacts to stop or otherwise control air handling unit fan motor(s) is to be provided by the Contractor. Provide auxiliary contacts as required. Zone wiring and indication for air duct smoke detectors shall be maintained separate from area detection devices. Detector shall be capable of being reset at the main control panel, and at a local test/reset station.

d. Where air duct smoke detectors are located in other than Mechanical Rooms, located in areas that are not readily accessible, or in spaces not easily visible, a remote alarm/power indicating LED key reset station shall be installed. These remotes shall be ganged together, if required, and labeled accurately as to which unit is reporting an alarm condition. Provide all labels in accordance with the owner’s labeling standards, and per the unit’s site designation(s).

e. Where air duct smoke detectors are indicated to be furnished at concealed air handling units above ceilings or smoke damper locations, furnish as outlined above. Also provide remote indicating alarm LED flush in corridor wall at 7'-0" A.F.F. immediately below installation, or as close as practical to installation. The Contractor is to provide control wiring, E.P. switches, etc., as required to operate smoke dampers, as well as the required operating circuit. Coordinate all requirements with the installer of smoke dampers.

f. Ionization - type detectors shall not be utilized for air duct smoke detection.

g. All air duct smoke detector installations and materials shall be in accord with U.L., NFPA, and any other applicable codes.

(9) CARBON MONOXIDE (CO) DETECTORS

a. The detector shall have the ability to detect Carbon Monoxide gases in compliance with UL 2075.

b. The detector shall automatically include drift compensation of CO cell.

c. Provide 24 Volt with Integral Sounder base connected to the SLC Addressable Circuit. Sounder shall be capable of providing a Temp 4 pattern for CO Alarm indication.

d. The sounder bases shall synchronize with it's native system.

e. The detector shall not be mounted within 10-0" of gas-burning appliance to avoid unnecessary false trips. Mount detectors in spaces as shown per manufacturer's installation guidelines, and in accordance with industry best practices.

(10) WEATHERPROOF DEVICES AND EXPLOSION-PROOF DEVICES

a. Where the anticipated atmosphere or installation conditions require weather-proof, explosion-proof or other specially housed devices, they shall be U.L.-listed and NFPA-compliant and provided as indicated or required. Verify installation conditions and indicate type of device on shop drawing submission.

(11) END OF LINE RESISTOR

a. End-of-line devices (if required) shall be flush-mounted, located at 7'-0" A.F.F. in corridor walls or as indicated.

(12) GUARDS FOR DEVICES

a. Where detectors, manual stations, signals, etc., require or are indicated to be furnished with a guard, utilize a U.L. listed unit, compactly covering and compatible with the device. Provide as indicated or required. Guards shall not diminish the performance of any device.

(13) DIGITAL ALARM COMMUNICATOR/TRANSMITTER

a. Provide a U.L.-listed and NFPA-compliant digital alarm communicator/transmitter (D.A.C.T.). Install at telephone terminal board or telephone service entrance and provide supervised wiring to fire alarm control panel as required. This unit may be semi-flush mounted at the F.A.C.P. location with prior approval by the Engineer. Where the F.A.C.P. is located in exposed public areas, semi-flush mounted at the

F.A.C.P. shall not be acceptable, unless otherwise approved by the owner and the engineer. The D.A.C.T. may also be integrated within the main control panel, if U.L.-listed for the purpose.

b. The installation and connection of the D.A.C.T. shall comply with all provisions of N.F.P.A. 71, N.F.P.A. 72 and all other applicable codes. The installation and connection shall be acceptable to the Authority Having Jurisdiction, as well as the telephone company (or companies) over whose lines the signal(s) will be transmitted. Include any costs associated with telephone company work and services required in bid. Telephone connection shall comply with NFPA 71, chapter five.

c. The D.A.C.T. shall be capable of transmitting all information relative to system status changes due to alarm, trouble, water flow, and any other information as required by current codes applicable to the facility. This information shall be transmitted to a U.L. listed Central Receiving Station, that also is maintained in accord with the requirements of NFPA 71. Connect system to transmit signals as required by local codes.

(14) REMOTE POWER SUPPLY UNITS FOR PERIPHERAL UNITS/DEVICES

a. Provide remote power supply(ies) as required for proper system operation.

b. Remote power supplies shall be provided with local intelligence compatible with the digital multiplex network, so they have a unique address, providing the ability to monitor the supply for loss of power, shorts, grounds and other supervisory functions.

c. Where required by the fire alarm system manufacturer, remote power supplies shall be provided that will provide sufficient current to drive audio/visual or other required devices.

d. These units shall be located in electrical closets, mechanical rooms or similar back-of-house spaces. They shall not be installed in finished areas, storage rooms, etc., without the permission of the Engineer and the owner. All locations shall be indicated on the shop drawing submissions.

e. Provide dedicated 120-volt power circuit(s) from nearby panelboards as required, whether indicated on the plans or not. This contractor shall be responsible for providing all necessary branch breakers and interconnecting devices for connection to existing electrical infrastructure, in accordance with manufacturer’s requirements for installation.

3. INSTALLATION AND TESTING

A. INSTALLATION

(1) Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All fire alarm wiring shall be installed in metal conduit where required by code, or an approved raceway/mounting method per NEC, dedicated to fire alarm device cabling. Fire alarm MC cable shall be an acceptable alternative for routing of new fire alarm circuitry in concealed areas that are not exposed to potential damage, weather, etc. All wiring shall be in a completely separate raceway system from power wiring or other raceway systems. Minimum conduit size shall be 3/4" trade size. Maximum wire fill shall be 40%, for any raceway system.

a. When utilizing MC cable for fire alarm wiring, MC cable shall be labeled every 20'-0" of run for fire alarm wiring only. All MC cabling shall be suitable for installation in a plenum.

b. All fire alarm cabling shall be suitable for installation in a plenum. Fire alarm cabling shall be labeled/supported per NEC requirements and local codes.

All junction boxes shall have coverplates painted **red** and labeled "Fire Alarm". A consistent wiring color code shall be maintained throughout the installation. The number of wiring splices shall be minimized throughout. Excessive wire splicing (as determined by the Engineer), shall be cause for rejection of the work.

(2) Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate tradesmen or other contractors.

(3) Support fire alarm wiring from structure, as required by code. Reference NEC articles 760 and 800, and all state/local codes. Final acceptance of supporting methods shall be confirmed by the AHJ and the engineer prior to final acceptance of methods.

(4) The Contractor shall clean all dirt and debris from both the inside and the outside of the fire alarm equipment after completion of installation.

(5) The manufacturer's authorized representative shall provide on-site supervision of installation, and shall perform the initial "power-up" of the system after he has thoroughly checked the installation.

(6) Operation and maintenance manuals submitted for this project shall list names, license numbers, and telephone numbers of at least two installers that are employed full time by the supplier/manufacturer to install and test fire alarm systems in the installation location.

(7) A floor plan drawing indicating fire alarm devices and wiring only, shall be provided by the manufacturing company for job site use. These drawings shall be approved by the State Fire Marshal's Office or Local Authority Having Jurisdiction, as appropriate and in accord with code requirements. A copy of this drawing shall be submitted to the Engineer for his review, approval and project records.

(8) A 2-year monitoring contract shall be included with the provision of all dedicated cellular systems installed serving the building fire alarm system. The monitoring contract shall

start at the time of substantial completion of the complete fire alarm system. Any temporary monitoring of the fire alarm system for system testing and startup prior to substantial completion shall be provided by the Contractor, and shall not require modification of the system for turnover to the main monitoring contract at the time of substantial completion.

Coordinate exact cellular requirements with the fire alarm system manufacturer prior to establishment of monitoring contract. Provide a copy of the monitoring contract to the owner for their records upon completing of system installation and testing. Monitoring contract shall include all necessary contacts and system information required for full system turnover. Refer to the fire alarm control panel product sections for additional information and associated requirements.

B. TESTING

(1) The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the Owner's representative and the Local Fire Marshal. Upon completion of a successful test, the Contractor shall certify the test results in writing to the Fire Marshal, Owner, General Contractor, Architect and Engineer. Provide one week's written advance notice of the test to all concerned parties.

(2) All auxiliary devices the fire alarm system is connected to, including tamper switches, flow switches, elevator controls, remote receiving stations, etc., shall be fully tested for proper operation where interfacing with the fire alarm system.

(3) The Contractor shall provide a minimum of three hours of instructional time to the Owner in the operation and maintenance of all equipment and components. A receipt shall be obtained from the Owner that this has been accomplished, and a copy forwarded to the Engineer. Provide additional training time if required by the Owner at no charge to the contract or as direct charge to the Owner.

a. This contractor shall provide a typewritten and digital “Sequence of Operation” manual with functional descriptions to the owner upon closeout of training. Provide a minimum of three (3) copies to the owner upon system closeout. Digital copies shall be provided on a flash-drive or similar digital media storage device, as confirmed by the owner.

C. WARRANTY

(1) The Contractor shall unconditionally guarantee (except for vandalism or misuse) the completed fire alarm system wiring and equipment to be free from inherent mechanical, software and electrical defects for a period of two years from the date of substantial completion.

(2) The equipment manufacturer shall make available to the Owner a maintenance contract proposal to provide a minimum of two inspections and tests per year in compliance with NFPA-72H guidelines.

(3) The Contractor shall provide add—alternate pricing for the extension of the warranty period, as well as the monitoring contract, as follows. Refer to the front-end specifications for additional information regarding alternates:

a. Provide add-alternate pricing for a one (1) year extension of the fire alarm system warranty period, maintenance contract and monitoring contract, in conformance with all requirements as listed above.

b. Provide add-alternate pricing for a two (2) year extension of the fire alarm system warranty period, maintenance contract and monitoring contract, in conformance with all requirements as listed above.

END OF SECTION 28 31 00

SECTION 28 48 00 - TWO-WAY EMERGENCY COMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: This section includes equipment for providing two-way emergency voice communication for elevator landings or areas of refuge.

B. Section Includes:
   1. Analog two-way emergency communications systems for rescue assistance.

1.3 REFERENCES

A. Abbreviations and Acronyms
   1. PSTN: Public Switched Telephone Network.
   2. UPS: Uninterruptable Power Supply

B. Reference Standards
   1. Underwriters Laboratories (UL)
      a. UL 2525, “Standard for Two-Way Emergency Communications Systems for Rescue Assistance”
      b. UL 60950, “Information Technology Equipment – Safety”

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Provide the following

   1. Wiring Diagrams detailing wiring for power, signal and control differentiating clearly between manufacturer installed wiring and field installed wiring.
   2. Arrangement of Components

C. Closeout Submittals
   1. Operation and Maintenance Data: For two-way communication system to include in operation and maintenance manuals.
   2. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:

a. Operating instructions laminated and mounted adjacent to operating console location.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installation, configuration, setup, program and related work shall be performed by a manufacturer's authorized representative who is thoroughly trained by the manufacturer in the installation and service of the equipment provided.
2. Installer shall maintain a fully staffed and equipped service office within 100 miles of the project that regularly offers maintenance and service for systems this design and size.

1.6 WARRANTIES

A. Manufacturer Warranty: Manufacturer agrees to repair or replace system, all of its component parts, wiring, and controls that fail within specified warranty period of 3 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

B. Comply with UL 2525.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Alpha Refuge
2. Rath
3. Talk-a-phone

2.3 COMPONENTS

A. Master Control Unit

1. Flush mounted steel enclosure with hinged door
2. Integral monitoring panel with LEDs to provide visual indication of the following:

a. Activation status of each remote call station
b. Trouble status of each call station pathway

c. Primary and Secondary power supply status
d. Telephone connection status

3. Handset with a coiled cord and keypad.
4. Audible and Visual sounder/strobe with trouble reset switch.
5. Public Switched Telephone Network (PSTN) Interface

a. The command unit shall be equipped with one (1) PSTN port.
b. The PSTN port shall interface through a terminal block.

6. Equipped with analog call station ports in order to support required number of analog remote call stations.
7. Programmable through the local command unit phone.
8. Primary Power Supply: Obtained from dedicated 120-V ac branch circuit and a high efficiency power-supply module to supply 24-V dc.
9. Secondary Power Supply: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch for 4 hours of system operation in the event of primary power source failure.

B. Analog Remote Call Station

1. Vandal proof stainless steel with engraved lettering.
2. ADA compliant, flush mounted.
3. “PUSH FOR HELP” button.
4. Red LED indicators to confirm transmission of “Help Requested” signal.
5. Piezoelectric alarm.
6. Hands-free internal speaker and microphone.
7. Dual audio and visual alarms for the hearing and visually impaired.
8. Powered from master control unit unless noted otherwise.
9. Programmable with built in supervised communications and failure relay output.

C. Power Supply

1. The command unit shall be powered by a built-in Uninterruptible Power Supply (UPS).
2. Provide minimum of four hours backup time in the event of primary power source failure.
3. Each analog call station interface port shall provide power to one (1) analog call station through one (1) twisted, shielded pair

D. Signage

1. Provide code required tactile signs with raised letter and braille at each remote call station with directions for using the call stations.

E. Cabling

1. 2-hour fire-rated circuit integrity cable or other 2-hour rated cabling system.

2.4 SYSTEM SEQUENCE OF OPERATION

A. When in use the system shall provide two-way audio communications between the Master control station unit, remote call station and/or a call to “9-1-1”. Communication at the remote call station shall be hands-free after initial contact from the area station.

Call out to “9-1-1” shall be a timed occurrence when the master station has not been picked up after a call from a remote station.

B. When an emergency call is placed by the master unit, it provides the following indications at the area remote call station to assure the caller that the call is being processed. After pressing the “PUSH FOR HELP” call button:
   1. Audio and visual confirmation:
      a. A “HELP REQUESTED” LED shall illuminate.
      b. An audible alarm shall sound.

C. The Master control unit allows Emergency Personnel to check status of each remote call station and to talk with each remote call station on an individual basis or all of them together.

D. A lighted green LED labeled “RESCUE SERVICES” indicates that an emergency is in progress.

E. If an emergency call is in progress, by lifting the handset on the master control unit you can automatically join the conversation. At this point you can place any or all remote call stations on hold by pushing the hold button corresponding to that unit, which will leave them talking to the called party. Or you can disconnect the called party by pressing the “DISCONNECT TO CALL SERVICES” button, which will leave you talking to the remote area unit.

F. If there is no emergency call in progress you can call into any or all remote call station by pressing the corresponding talk button to that unit.

G. By hanging up the master station you disconnect from the conversation while leaving the remote area station continuing any ongoing conversation with the called party.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive system components for compliance with 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. Comply with Manufacturers installation and programming instructions.

B. Mount devices plumb and rigid without distortion of boxes. Ensure recessed devices are flush with wall finish and mating with back box.

C. Locate devices to ensure conformance with ADA requirements.

D. Ground any cable shields at common point only at master control unit. Preserve continuity of shields at connecting points.

E. Wiring
   1. Provide telephone line from nearest telecomm room for system PSTN interface.
   2. All communication pathways between the remote call stations and the master control unit shall be monitored for integrity.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553, “Identification for Electrical Systems”
   1. Identify system components, wiring, cabling, and terminals.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and inspections: Perform manufacturer's recommended tests and inspections.

C. Functional Test: Perform functional tests that include activation of each remote call stations and ensuring proper communication with master control unit. Verify the call out function to “9-1-1” properly calls out after the set duration.

D. Nonconforming Work:
   1. Device will be considered defective if it does not pass tests and inspections.
   2. Remove and replace defective units and retest.

E. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain two-way communication system.

END OF SECTION 28 48 00

SECTION 31 05 13 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subsoil.
2. Topsoil.

B. Related Requirements:

1. Section 310516 "Aggregates for Earthwork" for coarse and fine aggregate materials.
2. Section 312213 "Rough Grading" for removal of topsoil, rough grading, and filling associated with contouring of Site.
3. Section 312316 "Excavation" for excavating as required for building foundations and utilities within building perimeter.
4. Section 312316.13 "Trenching" for excavating as required for building foundations and utilities within building perimeter.
5. Section 312323 "Fill" for backfilling as required at building perimeter and Site structures to subgrade elevations.
6. Section 312500 "Erosion and Sedimentation Controls" for slope protection and erosion control.
7. Section 313213.16 "Cement Soil Stabilization" for treatment of existing Site subsoil for physical stability and to encourage stabilization prior to placement of subsequent construction.
8. Section 313716.13 "Rubble-Stone Riprap" for riprap and rock lining placed loose for soil stabilization and slope protection.
9. Section 320513 "Soils for Exterior Improvements" for subsoil and topsoil materials.
10. Section 320516 "Aggregates for Exterior Improvements" for coarse and fine aggregate materials.
11. Section 329119 "Landscape Grading" for placing, leveling, and compacting topsoil materials prior to final landscaping Work.
12. Section 329219 "Seeding" for fertilizing, seeding, hydroseeding, mulching, and maintenance.
13. Section 329300 "Plants" for preparation of subsoil and topsoil, topsoil bedding , trees, plants, ground cover, mulch, fertilizer, pruning, and maintenance.
14. Document Report of Geotechnical Exploration for Jarrettown Elementary School dated January 19, 2026, prepared by David Blackmore and Associates, Inc. for geotechnical report; bore hole locations and findings of subsurface materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Samples: Submit, in airtight containers, 65-lb. or two (2) five-gallon samples of each type of imported fill to owner's geotechnical consultant for laboratory testing.

1.3 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For subsoil and topsoil materials.

1. Imported subsoil and topsoil shall meet all PADEP Clean Fill standards with required certifications to be submitted prior to placement of fill.

1.4 QUALITY ASSURANCE

A. Furnish each subsoil and topsoil material from single source throughout Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

2.2 SOIL

A. Subsoil Imported and on-site subsoil borrow material shall be suitable soil approved for specific use on the site by the owner’s geotechnical representative in accordance with the geotechnical report.
B. Topsoil : All stockpiled topsoil shall be used for all lawn areas. In the event there is a shortage of stockpiled topsoil the Contractor shall import topsoil at their expense to meet minimum depth specified.

1. Imported top soil shall be screened and be natural, fertile, friable loam or sandy loam as classified by the U. S. Department of Agriculture Soil Classification system, and typical of the cultivated topsoils of locality. The soil shall contain not less than 1% or more than 8% by weight, of decayed organic matter (humus), as determined by ASTM F 1647. The topsoil shall be taken from a well drained, arable site, free from sub-soil, large stones greater than ½ inch or ¼ inch (if for athletic use), earth clods, sticks, stumps, clay lumps, roots, or other objectionable, extraneous matter of debris. Topsoil shall also be free of Quackgrass rhizomes, Agropyron Repens, and the nut-like tubers of Nutgrass, Cyperus Esculentus, and all other primary noxious weeds. Topsoil shall not have a pH of less than 6.0 or greater than 7.5. Topsoil shall not be delivered or used

for planting while in a frozen or muddy condition. The topsoil shall be approved by the Architect prior to use and after review of a test report.

a. Topsoil shall conform to the following particle size distribution, as determined by pipette method in compliance with ASTM F1632.

1) Sand (22 to 2 mm): 40% to 60%
2) Silt (23 to 0.5 mm): 30% to 40%
3) Clay (<0.002 mm): 10% to 20%
4) Gravel (>2.0 mm): <15%

b. All Topsoil whether from onsite sources or imported shall have a maximum stone size of shall be 1/2 inches largest diameter. Topsoil whether from onsite sources or imported for use on practice or competition playing fields shall have a maximum stone size limited to ¼ inch.

1) If organic amendments are needed to obtain the specified organic matter content of the topsoil, the organic matter source may be a peat or compost material. The peat shall be Canadian sphagnum peat having an ash content not exceeding 15%, as determined by ASTM D 2974. Composts may be used, provided that the material has been composted in an in-vessel system and has an ash content not exceeding 40%, and is screened to 1/4 inch.

c. In the event there is a surplus of stockpiled topsoil then the Contractor shall deposit and spread the topsoil to a maximum depth of 8 inches as directed by the Architect. Surplus topsoil shall not be removed from the site unless directed by the Architect and authorized by the owner and approved by the municipality.

2.3 SOURCE QUALITY CONTROL

A. Testing and Analysis:

1. Subsoil Material: Comply with ASTM D698.
2. Topsoil Material: Comply with ASTM D5268.
3. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Owner's Geotechnical Consultant for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the work in accordance with the geotechnical report.

3.2 INSTALLATION OF SUBSOIL

A. Excavation:

1. Excavate subsoil from designated areas.
2. Remove excess excavated materials and subsoil not intended for reuse from Site.
3. Remove excavated materials not meeting requirements for subsoil materials from Site.

B. Stockpiling:

1. Stockpile excavated material meeting requirements for subsoil materials.
2. Stockpile materials on Site at locations as indicated or within the limits of disturbance and approved by Architect.
3. Stockpile in sufficient quantities to meet Project schedule and requirements.
4. Separate differing materials with dividers or stockpile apart to prevent intermixing of soil types or contamination.
5. Direct surface water away from stockpile to prevent erosion or deterioration of materials.

3.3 INSTALLATION OF TOPSOIL

A. Excavation:

1. Excavate topsoil from designated areas.
2. Strip topsoil to full depth of topsoil in designated areas.
3. Remove excess excavated materials not intended for reuse from Site.
4. Remove excavated materials not meeting requirements for topsoil materials from Site.

B. Stockpiling:

1. Stockpile excavated material meeting requirements for topsoil materials.
2. Stockpile materials on Site at locations as indicated. Other locations not indicated on the drawings may be utilized for stockpiling if within the limit of disturbance and approved by the Architect.
3. Stockpile in sufficient quantities to meet Project schedule and requirements.
4. Separate differing materials with dividers or stockpile apart to prevent intermixing of soil types or contamination.
5. Stockpile topsoil maximum **35 feet** high.
6. Direct surface water away from stockpile to prevent erosion or deterioration of materials.

3.4 CLEANING

A. Stockpile:

1. Remove stockpile and leave area in clean and neat condition.

    a. Grade Site surface to prevent freestanding surface water.
    b. Fine grade, topsoil and re-seed stockpile area as applicable.

END OF SECTION 31 05 13

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SECTION 31 05 16 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse aggregate.

B. Related Requirements:

1. Section 310513 "Soils for Earthwork" for granular fill, topsoil, and grading materials.
2. Section 312213 "Rough Grading" for removal of topsoil, rough grading, and filling associated with contouring of Site.
3. Section 312316 "Excavation" for excavating as required for building foundations and utilities within building perimeter.
4. Section 312316.13 "Trenching" for excavating as required for building foundations and utilities within building perimeter.
5. Section 312323 "Fill" for backfilling as required at building perimeter and Site structures to subgrade elevations.
6. Section 312500 "Erosion and Sedimentation Controls" for slope protection and erosion control.
7. Section 313213.16 "Cement Soil Stabilization" for treatment of existing Site subsoil for physical stability and to encourage stabilization prior to placement of subsequent construction.
8. Section 313716.13 "Rubble-Stone Riprap" for riprap and rock lining placed loose for soil stabilization and slope protection.
9. Section 320513 "Soils for Exterior Improvements" for subsoil and topsoil materials.
10. Section 320516 "Aggregates for Exterior Improvements" for coarse and fine aggregate materials.
11. Section 321123 "Aggregate Base Courses" for subbase and base course for placement under asphalt or concrete paving, unit paving, or placed and left exposed.
12. Section 321413 "Precast Concrete Unit Paving" for precast, extruded, or hydraulically pressed concrete paver units of interlocking or butt-edge design.
13. Section 329119 "Landscape Grading" for placing, leveling, and compacting topsoil materials prior to final landscaping Work.
14. Section 331416 "Site Water Utility Distribution Piping" for pipe materials, fittings, valves, meters, and backflow preventers.
15. Section 333100 "Sanitary Sewerage Piping" for pipe materials and accessories normally encountered with gravity sanitary building piping.
16. Section 334200.01 "Stormwater Conveyance for Infrastructure" for drainage facilities to collect and provide for the flow of stormwater.
17. Document Report of Geotechnical Exploration for Jarrettown Elementary School

dated January 19, 2026. prepared by David Blackmore and Associates, Inc. for geotechnical report; bore hole locations and findings of subsurface materials.

18. Section 312000 "Earth Moving" for subbase preparation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1.3 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For coarse aggregate materials.

1.4 QUALITY ASSURANCE

A. Furnish each coarse aggregate material from single source throughout Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work in accordance with:

1. The State of Pennsylvania Department of Transportation standards.

2.2 AGGREGATE

A. Coarse Aggregate : All imported coarse aggregate shall meet the requirements of Per PennDOT Publication 408 Specifications, current edition. On-site borrow aggregate shall meet the performance characteristics as determined and documented/approved by the geotechnical engineer in the geotechnical report as well as the owner’s geotechnical field representative during construction.

1. Type AASHTO #57 Stone: Comply with PennDOT Publication 408, Section 703.2, Table C:

a. Percent Passing According to Sieve Size:

1) 1-1/2 inches (37.5 mm): 100.
2) 1 inch (25 mm): 95 to 100.
3) 1/2 inch (12.5 mm): 25 to 60.
4) No. 4 (4.75 mm): 0 to 10.
5) No. 8 (2.36 mm): 0 to 5.

2. Type AASHTO #8 Stone: Comply with PennDOT Publication 408, Section 703.2, Table C.

a. Percent Passing According to Sieve Size:

1) 1/2 inch (12.5 mm): 100
2) 3/8 inch (9.5 mm): 85 to 100.
3) No. 4 (4.75 mm): 10 to 30.
4) No. 8 (2.36 mm): 0 to 10.
5) No. 16 (1.18 mm): 0 to 5.

3. Type PennDOT 2A Aggregate: Comply with PennDOT Publication 408, Section 703.2, Table C:

a. Percent Passing According to Sieve Size:

1) 2 inches (50 mm): 100.
2) 3/4 inch (19 mm): 52 to 100.
3) 3/8 inch (9.5 mm): 36 to 70.
4) No. 4 (4.75 mm): 24 to 50.
5) No. 16 (1.18 mm): 10 to 30.
6) No. 200 (75 micro m): 10 max.

2.3 SOURCE QUALITY CONTROL

A. Testing and Analysis:

1. Coarse Aggregate Material: Comply with ASTM D4318.
2. If tests indicate materials do not meet specified requirements, change material and retest.

B. Certificate of Compliance:

1. If supplier is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at source conforms to Contract Documents.
2. Specified source tests are not required for Work performed by approved supplier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Owner's Geotechnical Consultant for compliance with requirements for maximum moisture content, installation tolerances, compaction and other conditions affecting performance of the Work.

3.2 INSTALLATION OF COARSE AGGREGATE

A. Excavation: (for the of on-site borrow coarse aggregate if documented/approved by

Geotechnical Engineer in the geotechnical report as well as the owner's on-site geotechnical representative during construction)

1. If applicable, excavate aggregate materials from Site locations as documented in the geotechnical report.
2. Remove excess excavated coarse aggregate materials not intended for reuse from Site.
3. Remove excavated materials not meeting requirements for coarse aggregate from Site.

B. Stockpiling:

1. Stockpile materials on Site at locations as indicated or approved by Architect.
2. Stockpile excavated material meeting requirements for coarse aggregate materials.
3. Stockpile in sufficient quantities to meet Project schedule and requirements.
4. Separate different aggregate materials with dividers or stockpile apart to prevent intermixing of aggregate types or contamination.
5. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 CLEANING

A. Stockpile:

1. Remove stockpile and leave area in clean and neat condition.

    a. Grade Site surface to prevent freestanding surface water.
    b. Fine grade, topsoil and re-seed stockpile area as applicable.

END OF SECTION 31 05 16

SECTION 31 05 19.13 - GEOTEXTILES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Woven turf reinforcement mats (TRMs).
2. Nonwoven geotextile materials.

B. Related Requirements:

1. Section 310513 "Soils for Earthwork" for fill and grading materials.
2. Section 310516 "Aggregates for Earthwork" for fill and base coarse materials, and for fill over woven geotextiles at roadway applications.
3. Section 312316.13 "Trenching" for soil and subsoil materials for fill and grading purposes.
4. Section 312323 "Fill" for backfilling required at building perimeter and Site structures to subgrade elevations; fill under slabs on grade, pavement, and landscaped areas.
5. Section 312500 "Erosion and Sedimentation Controls" for erosion and sedimentation control devices.
6. Section 320513 "Soils for Exterior Improvements" for soil and subsoil materials for fill and grading purposes.
7. Section 320516 "Aggregates for Exterior Improvements" for coarse and fine aggregate materials for fill and grading purposes.
8. Section 321123 "Aggregate Base Courses" for subbase and base course for placement under paving.
9. Section 329119 "Landscape Grading" for placing, leveling, and compacting topsoil materials prior to final landscaping.
10. Document Report of Geotechnical Exploration for Jarrettown Elementary School dated January 19, 2026. prepared by David Blackmore and Associates, Inc. for geotechnical report; borehole locations and findings of subsurface materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer information including tensile strength, elongation, thickness, UV resistance, and other material specifications.
2. Include testing agency compliance with the Geosynthetic Accreditation Institute's Laboratory Accreditation Program (GAI-LAP).

B. Shop Drawings:

1. Indicate fabric layout, seam locations, and overlap details in installation drawings.
2. Seaming Procedures: When a field-sewn seam is required, use high-strength polypropylene or polyester threads. Do not use nylon thread. Comply with ASTM D4884/D4884M. Use the following guidelines for seams sewn in the field:

    a. Provide a minimum length of six (6) feet of the sewn seam for sampling by the Architect/Engineer prior to geotextile installation.
    b. Provide sample using the same equipment and procedures utilized in production of the geotextile.
    c. Submit the seam assembly description, including the seam type, stitch type, sewing thread, and stitch density, along with the sample of the seam.

3. Signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For TRMs and woven and nonwoven geotextiles.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of geotextile materials, including placement depth.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials:

1. Furnish two seam repair kits.
2. Furnish ten (10) sq. yd. of geotextile material.

B. Tools: Furnish special tools and other devices required for Owner to maintain and repair geotextile material.

1.6 QUALITY ASSURANCE

A. Licensed Professional Qualifications: Professional engineer experienced in design of specified Work and licensed in State of Pennsylvania.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
B. Comply with ASTM D4873.
C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

B. Ensure that terminology incorporated herein complies with ASTM D4439.

2.2 GEOTEXTILES

A. Woven Turf Reinforcement Mats (TRMs):

1. Provide woven turf reinforcement mats (TRMs) with sufficient thickness, optimum open area, and three-dimensionality for effective erosion control and vegetation reinforcement against high flow-induced shear forces. Provide material that has high interlock and reinforcement capacity with both soil and root systems and is designed for erosion control applications on steep slopes and vegetated waterways.
2. Basis-of-Design Product: Provide North American Green; VMax C350 and relevant technical details including physical, functional, or performance characteristics of the named product that an "equal" item must meet to be deemed acceptable from one of the following:

    a. American Excelsior Company
    b. Propex Geosolutions (Solmax)
    c. Western Green

3. Non-biodegradable, UV-resistant, woven geotextile fabric.
4. Permanent, Triple Net, Organic Fiber Matrix, Turf Reinforcement Mat.
5. Edges: Selvaged or finished to prevent separation of outer material.
6. Calendar such that yarns will retain relative positions.
7. Performance and Design Criteria:

    a. Comply with AASHTO M 288.
    b. Mass per Unit Area:

        1) 15 oz./sq. yd.
        2) Comply with ASTM D6566.

c. Thickness:

1) 0.58 inch.
2) Comply with ASTM D6525/D6525M.

d. Light Penetration:

1) Light Passing: 10 percent.
2) Comply with ASTM D6567.

e. Tensile Strength (Grab):

1) 750 lb./ft by 750 lb./ft.
2) Comply with ASTM D6818.

f. Maximum Elongation:

1) 30 by 20 percent.
2) Comply with ASTM D6818.

g. UV Resistance at 6,000 Hours:

1) Strength Retention: 90 percent.
2) Comply with ASTM D4355/D4355M.

h. Velocity Performance:

1) Velocity (Vegetated): 18.0 fps.

i. Seeding Emergence:

1) 350 percent.
2) Comply with ASTM D7322.

B. Nonwoven Geotextile Materials:

1. Provide nonwoven geotextile that meets AASHTO M 288 Class 1 requirements for subsurface drainage, separation, and stabilization. Provide multipurpose fabrics with a felt-like appearance. The main functions for these products are filtration and separation. The most common nonwoven is a needle-punched product. Staple fibers or continuous filaments are bonded by mechanically entangling the fibers with barbed needles. Their optimum open area and three-dimensionality provide effective erosion control and vegetation reinforcement, as well as resistance against high flow-induced shear forces. Provide material that has high interlock and reinforcement capacities with both soil and root systems and is designed for erosion control applications on steep slopes and vegetated waterways.
2. Basis-of-Design Product: Provide TenCate Miriafi; 180N and relevant technical details including physical, functional, or performance characteristics of the named product that an "equal" item must meet to be deemed acceptable from one of the

following:

a. TenCate Mirafi
b. DuPont
c. Typar

3. Non-biodegradable, UV-resistant, nonwoven geotextile fabric.
4. Edges: Selvaged or finished to prevent separation of outer material.
5. Calendar such that yarns will retain relative positions.
6. Performance and Design Criteria:

a. Minimum Unseamed Sheet Width: 12.5 by 15 feet.
b. Nominal Weight: 8.0 oz./sq. yd.
c. Apparent Opening Size (AOS):

1) No 80 U.S. standard sieve size.
2) Comply with ASTM D4751.

d. Water Permittivity: 1.1 Hz per second, minimum average roll value.
e. Water Flow Rate:

1) 95 gpm/sq. ft., minimum average roll value.
2) Comply with ASTM D4491/D4491M.

f. Grab Tensile Strength:

1) 205 lbf, minimum average roll value.
2) Comply with ASTM D4632/D4632M.

g. Elongation:

1) 50 percent, minimum average roll value.
2) Comply with ASTM D4632/D4632M.

h. Trapezoidal Tear Strength:

1) 80 lbf minimum average roll value.
2) Comply with ASTM D4533/D4533M.

i. Puncture Strength:

1) 500 lbf minimum average roll value.
2) Comply with ASTM D6241.

j. UV Resistance at 500 Hours:

1) Strength Retention: 70 percent.
2) Comply with ASTM D4355/D4355M.

2.3 ACCESSORIES

A. Sewing Thread:

1. Material: Polypropylene or Polyester.
2. Durability: Equal to or greater than durability of geotextile.

B. Securing Pins:

1. Material: Steel rods .
2. Diameter: 3/16 inch.
3. Minimum Length: 12 inches.
4. Washers:

a. Material: Steel.
b. Outside Diameter: Minimum 1-1/2 inches.
c. Inside Diameter: 1/4 inch.
d. Thickness: 1/8 inch.

C. Wire Staples:

1. Material: Steel.
2. Minimum Size: 10 gage.
3. Minimum Length: 6 inches.

2.4 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly. Provide sampling of geosynthetics for testing in compliance with ASTM D4354.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents and GAI-LAP.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Owner's Geotechnical Consultant , with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances, compaction and other conditions affecting performance of the Work.
B. Verify that underlying surface is smooth and free of ruts or protrusions that could

damage geotextile material.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Subgrade Material and Compaction Requirements: As specified in Section 312316.13 "Trenching" and 312323 "Fill".

3.3 INSTALLATION OF WOVEN TURF REINFORCEMENT MATS (TRMS)

A. Geotextile Material:

1. Lay and maintain smooth and free of tensile stresses, folds, wrinkles, or creases.
2. Ensure that material is in direct contact with subgrade.
3. Orientate with long dimension of each sheet transverse to direction of slope.
4. Minimum Unseamed Joints Overlap: 24 inches.

B. Securement Pins:

1. Install pins spaced in accordance with staple pattern detail as indicated on Drawings.
2. Ensure that washer bears against geotextile.

C. Seams:

1. Minimum Seamed Joints Overlap: 12 inches at longitudinal and transverse joints.
2. Seams across Slope: Lap upper panel over lower panel.
3. Sewn Seams:

    a. Continuously sew seams on slopes steeper than 1 vertical on 4 horizontal.
    b. Continuously sew seams at locations indicated on Drawings.
    c. Stitch Type: As recommended by geotextile manufacturer.
    d. Tie off thread at the end of each seam to prevent unraveling.

4. Thermal Seams:

    a. As recommended by geotextile manufacturer.
    b. Comply with ASTM D4886.

D. Penetrations: As recommended by geotextile manufacturer.

E. Repair Damaged Geotextiles:

1. Repair torn or damaged geotextile by placing patch of same type of geotextile over damaged area minimum of 24 inches beyond edge of damaged area and fasten as recommended by geotextile manufacturer.
2. Remove and replace geotextile rolls which cannot be repaired.

F. Fill and Cover:

1. Place fill to prevent tensile stress or wrinkles in geotextile.
2. Place fill from bottom of side-slopes upward.
3. Do not drop fill from height greater than 3 feet.

3.4 INSTALLATION OF NONWOVEN GEOTEXTILE MATERIALS

A. Geotextile Material:

1. Lay and maintain smooth and free of tensile stresses, folds, wrinkles, or creases.
2. Ensure that material is in direct contact with subgrade.
3. Orientate with long dimension of each sheet transverse to direction of slope.
4. Minimum Unseamed Joints Overlap: 24 inches.

B. Securement Pins:

1. Install pins spaced in accordance with staple pattern detail as indicated on Drawings.
2. Ensure that washer bears against geotextile.

C. Seams:

1. Minimum Seamed Joints Overlap: 12 inches at longitudinal and transverse joints.
2. Seams across Slope: Lap upper panel over lower panel.
3. Sewn Seams:

    a. Continuously sew seams on slopes steeper than 1 vertical on 4 horizontal.
    b. Continuously sew seams at locations indicated on Drawings.
    c. Stitch Type: As recommended by geotextile manufacturer.
    d. Tie off thread at the end of each seam to prevent unraveling.

4. Thermal Seams:

    a. As recommended by geotextile manufacturer.
    b. Comply with ASTM D4886.

D. Penetrations: As recommended by geotextile manufacturer.
E. Repair Damaged Geotextiles:

1. Repair torn or damaged geotextile by placing patch of same type of geotextile over damaged area minimum of 24 inches beyond edge of damaged area and fasten as recommended by geotextile manufacturer.
2. Remove and replace geotextile rolls which cannot be repaired.

F. Fill and Cover:

1. Place fill to prevent tensile stress or wrinkles in geotextile.
2. Place fill from bottom of side-slopes upward.
3. Do not drop fill from height greater than 3 feet.

3.5 PROTECTION

A. Ballast: Adequate to prevent uplift of material by wind.
B. UV Exposure: Do not leave material uncovered for more than 14 days after installation.
C. Do not use staples or pins to hold geotextiles in place where located adjacent to other geosynthetic layers that could be damaged.
D. Do not operate equipment directly on top of geotextiles.

END OF SECTION 31 05 19.13

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SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Satisfactory soil material.
2. Antirust coating.
3. Temporary erosion and sedimentation control.
4. Tree and plant protection.
5. Existing utilities.
6. Clearing and grubbing.
7. Topsoil stripping.
8. Stockpiling rock.
9. Site improvements.
10. Disposal of surplus and waste materials.

1.2 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
C. Topsoil:

1. Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction as indicated on Drawings.
F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions Documentation: Include documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil Stripping and Stockpiling Program: For salvaging and reusing topsoil at Project site.
C. Rock Stockpiling Program: For salvaging and reusing rocks at Project site.
D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
C. Utility Locator Service: Notify One Call for area where Project is located before site clearing.
D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
E. Tree- and Plant-Protection Zones: Protect in accordance with requirements in Section 015639 "Temporary Tree and Plant Protection."
F. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #23 (surface-tolerant, anticorrosive metal primer).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.
B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed in accordance with requirements in Section 015639 "Temporary Tree and Plant Protection."
C. Protect existing site improvements to remain free from damage during construction.
D. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, in accordance with erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site in accordance with requirements in Section 015639 "Temporary Tree and Plant Protection."
B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations in accordance with requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Locate, identify, and disconnect utilities indicated to be abandoned in place.
C. Interrupting Existing Utilities: 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 in accordance with requirements indicated:

1. Notify Architect not less than seven days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 24 inches below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Satisfactory Soil Material: Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.
B. Strip topsoil to depth as neccessary in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or

other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 35 feet.
2. Do not stockpile topsoil within protection zones.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Antirust Coating: Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 10 00

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SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil materials.
2. Geotextiles.
3. Controlled low-strength material.
4. Accessories.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" Section 013233 "Photographic Documentation" for recording preexcavation and earth-moving progress.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
4. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
5. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."
B. Quantity allowances for earth moving are included in Section 012100 "Allowances."
C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 6 inches beneath bottom of concrete slabs-on-grade.
6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 36 inches wide.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course:Asphalt layer placed between the subbase course and binder course of the asphalt paving section.
C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for in accordance with Contract provisions for unit prices.
2. Bulk Excavation: Excavation more than 10 ft. in width and more than 30 ft. in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, will be without additional compensation.

G. Fill: Soil materials used to raise existing grades.
H. Rock:

1. Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 1 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

a. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
b. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other fabricated stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site with Architect, Engineer, Construction Manager, and Owner's Geotechnical Consultant.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.
b. Coordination of Work with utility locator service.
c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
d. Extent of trenching by hand or with air spade.
e. Field quality control.
f. Procedures for Authorization of Additional Excavation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1.6 INFORMATIONAL SUBMITTALS

A. Material Test Reports:Contractor shall submit to the Owner's Geotechnical Consultant for review and approval each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification in accordance with ASTM D2487.
2. Laboratory compaction curve in accordance with ASTM D698.

B. Clean Fill Certificates:

1. Imported fill shall meet all PADEP Clean Fill Standards with required certifications submitted prior to placement of fill.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.
D. Qualification Statements: For qualified testing agency.

1.7 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Owner will engage a testing agency qualified in accordance with ASTM E329 and ASTM D3740 for testing indicated.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify "One Call" for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.

E. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Contractor shall import borrow materials when sufficient satisfactory soil materials other than structural fill as specified in the Geotechnical Report are not available from on-site excavations as not cost to owner to meet design graded and elevations for the site.
B. Subbase Material Shall meet the requirements of the following:

1. PennDOT No. 2A Coarse Aggregate
2. Select Granular Material 2RC (only where expressly indicated)

C. Base Course: Warm-Mix Asphalt meeting paving specification indicated on the Drawings.
D. Bedding Course: Shall meet the requirements of PennDOT No. 2A Coarse Aggregate.
E. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.
F. Sand: ASTM C33/C33M; fine aggregate.
G. Structural Fill: As specified in the Geotechnical Report:

1. On-Site Soils identified as Stratum II and Stratum III which are free of organic content and are maintained (nominally) at the optimum moisture for compaction as determined by ASTM D698.

a. Optimuim Moisture Content

1) Minimum: 10 percent
2) Maximum: 16 percent

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability:

a. Class 1; AASHTO M 288.

b. Apparent Opening Size: No. 80 sieve, maximum; ASTM D4751.
c. Permittivity: 0.1 per second, minimum; ASTM D4491/D4491M.
d. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation

applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability:

    a. Class 2; AASHTO M 288.
    b. As follows:

        1) Grab Tensile Strength: 247 lbf; ASTM D4632/D4632M.
        2) Sewn Seam Strength: 222 lbf; ASTM D4632/D4632M.
        3) Tear Strength: 90 lbf; ASTM D4533/D4533M.
        4) Puncture Strength: 90 lbf; ASTM D4833/D4833M.

    c. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.
    d. Permittivity: 0.02 per second, minimum; ASTM D4491/D4491M.
    e. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Produce conventional-weight, controlled low-strength material with maximum 500-psi compressive strength when tested in accordance with ASTM C495/C495M.

2.4 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives:

1. Do not use explosives. Blasting shall not be permitted.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions. (ALTERNATE)

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.
b. 12 inches outside of concrete forms at footings.
c. outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches and the greater of wider than pipe or 36

inches wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation in accordance with unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation. (BASE BID)

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

    a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches outside of concrete forms other than at footings.
    b. 12 inches outside of concrete forms at footings.
    c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches beneath bottom of concrete slabs-on-grade.
    f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 36 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks

to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots in accordance with requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to two (2) feet higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: As indicated.

C. Trench Bottoms:

1. Excavate trenches 6 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

a. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots in accordance with requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

A. Notify Architect and Owner's Geotechnical Consultant when excavations have reached required subgrade.

B. If Architect and Owner's Geotechnical Consultant determine that unsatisfactory soil is

present, continue excavation and replace with compacted backfill or fill material as directed and in accordance with geotechnical report. It shall be the responsibility of the contract to notify the Architect PRIOR to commencing Additional Excavation if the work will result in additional costs to the owner or be credited against a quantity allowance .

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired smooth drum roller weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for in accordance with Contract provisions for unit prices.It shall be the responsibility of the contractor to notify Architect PRIOR to commencing Additional Excavation if the work will result in additional costs to the owner or be credited against a quantity allowance.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage,

dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.
B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
C. Backfill voids with satisfactory soil while removing shoring and bracing.
D. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 to 24 inches as specified on Plan details over the pipe or conduit.

    a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 18 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
B. If fill for construction of embankments is to be placed on existing slopes steeper than 1 vertical to 4 horizontal, benches shall be cut into the slope so that fill can be placed in level lifts.
C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.

3. Under steps and ramps, use structural fill.
4. Under building slabs, use structural fill.
5. Under footings and foundations, use structural fill.

D. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry density.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 6 inches in loose depth for material compacted by hand-operated tampers.
B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
C. Compact soil materials to not less than the following percentages of maximum dry density in accordance with ASTM D698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 97 percent.
5. Berms (non-structural): 93 percent.

3.16 GRADING

A. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 0.10 feet.
2. Walks: Plus or minus 0.10 feet.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 0.10 foot when tested with a 10-foot straightedge.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Shape subbase course and base course to required crown elevations and cross-slope grades.
2. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
3. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight in accordance with ASTM D698.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 98 percent of maximum dry unit weight in accordance with ASTM D698.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.
B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade in accordance with manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight in

accordance with ASTM D698.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Compaction Testing: Testing agency will test compaction of soils in place in accordance with ASTM D1556/D15556M, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 50 ft. or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 50 ft. or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Contractor shall remove/export surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property at no additional cost to the Owner.

END OF SECTION 31 20 00

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SECTION 31 22 13 - ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fill materials.

B. Related Requirements:

1. Section 024116 "Structure Demolition" for demolition of structures, foundations, slabs on grade, and utilities.
2. Section 310513 "Soils for Earthwork" for soils for fill.
3. Section 310516 "Aggregates for Earthwork" for aggregates for fill.
4. Section 311000 "Site Clearing" for excavating topsoil.
5. Section 312316 "Excavation" for building excavation.
6. Section 312316.13 "Trenching" for trenching and backfilling for utilities.
7. Section 312316.26 "Rock Removal" for removal of rock during rough grading and excavation.
8. Section 312323 "Fill" for general building area backfilling.
9. Section 329119 "Landscape Grading" for finish grading with topsoil to contours.

1.2 ACTION SUBMITTALS

A. Samples: Submit, in airtight containers, 65-lb or two (2) five-gallon bucket sample of each type of fill to Owner's Geotechnical Consultant for laboratory testing.

1.3 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For imported subsoil and topsoil.

1. Imported subsoil and topsoil shall meet PADEP Clean Fill Standards with required certifications submitted prior to placement of fill.

B. Material Test Reports: For each imported fill material, by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of remaining utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, and ASTM D2434.
B. Furnish each coarse- aggregate material from single source throughout Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work in accordance with:

1. The State of Pennsylvania Department of Transportation standards.

2.2 FILL MATERIALS

A. Topsoil: Type as specified in Section 310513 "Soils for Earthwork".
B. Subsoil Fill: Type as specified in Section 310513 "Soils for Earthwork".
C. Structural Fill: Type PennDOT 2A Aggregate as specified in Section 312323 "Fill".
D. Granular Fill: Type as specified in Section the Geotechnical Report.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Owner's Geotechnical Consultant present, for compliance with requirements for maximum moisture content, installation tolerances compaction and other conditions affecting performance of the Work.
B. Verify survey benchmark and intended elevations for the Work are as indicated on Drawings.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Call local utility line information service at PA One-Call (800-242-1776) not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.
C. Notify appropriate utility companies to remove and relocate utilities.
D. Protect utilities indicated to remain free from damage.
E. Protect plant life, lawns, and other features remaining as portion of final landscaping.
F. Protect benchmarks, survey control point, existing structures, fences, sidewalks,

paving, and curbs from excavating equipment and vehicular traffic.

3.3 INSTALLATION OF FILL MATERIALS

A. Fill areas to contours and elevations with unfrozen materials.
B. Place fill material in continuous layers and compact .
C. Place material in continuous layers as follows:

1. Subsoil Fill: Maximum 8 inches compacted depth.
2. Structural Fill: Maximum 8 inches compacted depth.
3. Granular Fill: Maximum 8 inches compacted depth.

D. Maintain optimum moisture content of fill materials to attain required compaction density.
E. Slope grade away from building with a minimum 5 percent slope for minimum distance of 10 feet, unless noted otherwise.
F. Make grade changes gradual. Blend slope into level areas.
G. Repair or replace items damaged by excavation or filling.

3.4 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 feet from required elevation.

3.5 FIELD QUALITY CONTROL

A. Owner's Geotechnical Consultant shall perform laboratory material tests in accordance with ASTM D698.
B. Owner's Geotechnical Consultant shall perform in-place compaction tests in accordance with the following:

1. Density Tests: ASTM D1556 or ASTM D6938
2. Moisture Tests: ASTM D6938

C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
D. Owner's Geotechnical Consultant shall prepare test and inspection reports.

END OF SECTION 31 22 13

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SECTION 31 23 16 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation for building foundations, slabs on grade, and utilities within the building footprint.

B. Related Requirements:

1. Section 310513 "Soils for Earthwork" for stockpiling of fill and grading materials.
2. Section 310516 "Aggregates for Earthwork" for stockpiling of coarse- and fine-aggregate materials.
3. Section 312213 "Rough Grading" for topsoil and subsoil removal from Site surface.
4. Section 312316.13 "Trenching" for excavating as required for building foundations and utilities within building perimeter.
5. Section 312316.26 "Rock Removal" for removal of rock during excavating.
6. Section 312323 "Fill" for backfilling at building perimeter and Site structures, and fill under slabs on grade, pavement, and landscaped areas.
7. Section 312500 "Erosion and Sedimentation Controls" for slope protection and erosion control.
8. Section 331416 "Site Water Utility Distribution Piping" for pipe materials, fittings, valves, meters, and backflow preventers.
9. Section 333100 "Sanitary Sewerage Piping" for pipe materials and accessories normally encountered with gravity sanitary building piping.
10. Section 333413.13 "Concrete Septic Tanks" for materials and installation requirements for concrete septic tanks.
11. Section 333413.23 "Fiberglass Septic Tanks" for materials and installation requirements for fiberglass septic tanks.
12. Section 333413.33 "Polyethylene Septic Tanks" for materials and installation requirements for polyethylene septic tanks.
13. Section 335216 "Gas Hydrocarbon Piping" for pipe materials, fittings, and valves normally encountered with Site-piped natural gas or propane gas distribution systems.
14. Document Report of Geotechnical Exploration for Jarrettown Elementary School dated January 19, 2026 prepared by David Blackmore & Associates, Inc. for geotechnical report, bore hole locations, and findings of subsurface materials.

1.2 ACTION SUBMITTALS

A. Shop Drawings:

1. Excavation Protection Plan:

    a. Describe sheeting, shoring, and bracing materials and installation, as required, to protect excavations and adjacent structures and property.
    b. Submit signed and sealed Shop Drawings with design calculations and assumptions to support plan.

1.3 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports: For Contractor-furnished tests and inspections.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Owner's Geotechnical Consultant present, for compliance with requirements for maximum moisture content, installation tolerances compaction and other conditions affecting performance of the Work.

3.2 PREPARATION

A. Call local utility line information service at PA One-Call (800-242-1776) not less than three working days before performing Work.
B. Request that underground utilities be located and marked within and immediately surrounding Site.
C. Identify required lines, levels, contours, and data.
D. Existing Utilities:

1. Notify appropriate utility companies to remove and relocate utilities.
2. Protect from damage utilities indicated to remain.

E. Protect plant life, lawns, and other features designated to remain as portion of final landscaping.
F. Protect benchmarks, existing structures, fences, sidewalks, curbs, and survey control points from excavating equipment and vehicular traffic.
G. Do not close or obstruct roadways without permits.
H. Erect and maintain temporary barriers and security devices at indicated locations,

including warning signs, warning lights, and similar measures, for protection of public, Owner, and existing improvements indicated to remain.

3.3 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation Work.
B. Excavate subsoil to accommodate building foundations, slabs on grade, paving, Site structures, and construction operations.
C. Excavate to working elevation for piling Work.
D. Compact disturbed load-bearing soil in direct contact with foundations to original bearing capacity as specified in Section 312323 "Fill" and Section 312316.13 "Trenching".
E. Slope banks with machine to angle of repose or less until shored.
F. Do not interfere with 45 -degree bearing splay of foundations.
G. Grade top perimeter of excavation to prevent surface water from draining into excavation.
H. Trim excavation and remove loose matter.
I. Removal of Deleterious Materials:

    1. Remove lumped subsoil, boulders, and rock up to one (1) cu. yd., measured by volume.
    2. Remove larger material as specified in Section 312323 "Fill".
    3. Remove excess and unsuitable material from Site.

J. Notify Architect and Owner's Geotechnical Consultant of unexpected subsurface conditions.
K. Correct over-excavated areas as specified in Section 312323 "Fill."
L. Repair or replace items indicated to remain that have been damaged by excavation.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

    1. Request visual inspection of bearing surfaces by Owner's Geotechnical Consultant before installing subsequent Work.

B. Owner's Geotechnical Testing Agency shall perform at least one field density test of subgrade for every 2,000 sq. ft. of building slabs and paved area, but in no case fewer than three tests. In each compacted fill layer, perform one field density test for every 1,000 sq. ft. of overlaying paved area, but in no case fewer than three tests.
C. Owner's Geotechnical Testing Agency shall perform one field density test per 50 lineal feet of each side of the wall per foot of backfill or fill, with no fewer than three tests per lift.
D. Prepare test and inspection reports.

3.5 PROTECTION

A. Prevent displacement or loose soil from falling into excavation and maintain soil stability.
B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
C. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that may be created by earth operations.

END OF SECTION 31 23 16

SECTION 31 23 16.13 - TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fill materials.
2. Temporary steel plates.
3. Geotextiles.

B. Related Requirements:

1. Section 033000.01 "Cast-in-Place Concrete for Infrastructure" for concrete materials.
2. Section 310513 "Soils for Earthwork" for soils for fill.
3. Section 310516 "Aggregates for Earthwork" for aggregates for fill.
4. Section 310519.13 "Geotextiles for Earthwork."
5. Section 312213 "Rough Grading" for topsoil and subsoil removal from Site surface.
6. Section 312316 "Excavation" for general building excavation.
7. Section 312316.26 "Rock Removal" for removal of rock during excavating.
8. Section 312323 "Fill" for general backfilling.
9. Section 329119 "Landscape Grading" for filling of topsoil over backfilled trenches to finish grade elevation.
10. Section 333100 "Sanitary Sewerage Piping" for sanitary sewer piping and bedding from building to connection to sanitary main.
11. Document Report of Geotechnical Exploration for Jarrettown Elementary School, dated January 19, 2026, prepared by David Blackmore & Associates, Inc. for geotechnical report, bore hole locations, and findings of subsurface materials.

1.2 DEFINITIONS

A. Excavator: Any entity including, but not limited to, a person, partnership, joint venture, trust, corporation, association, public utility, company, or state or local government body or public agency which performs excavation operations, including the excavation of trenches.
B. Trench: An excavation which is narrow in relation to its length and deeper than it is wide, made more than three feet below grade, with width no greater than 15 feet as measured from the bottom.
C. Trench Shoring: The methods and equipment, including shores and props, used to brace the walls of a trench during excavation work and to prevent the trench walls from collapsing into the trench. Also referred to as trench bracing or trench lining.
D. Utility: Any buried pipe, duct, conduit, or cable.

1.3 ACTION SUBMITTALS

A. Excavation Protection Plan: Describe sheeting, trench shoring shields, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan. Prepare design calculations and drawings, stamped and signed by a professional engineer registered in the State of Pennsylvania, who is experienced in designing excavation support systems.
B. Product Data: Submit data for sheeting, shoring, trench shoring shields, and geotextile fabric indicating fabric and construction.
C. Samples:

1. Submit, in airtight containers, 65 lbs. or two (2) five-gallon bucket sample of each type of imported fill to Owner's Geotechnical Consultant for laboratory testing.

1.4 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For imported subsoil.
B. Material Test Reports: For each imported fill material, by a qualified testing agency.

1. Imported subsoil and fill shall meet all PADEP Clean Fill Standards with required certification submitted prior to placement of fill.

1.5 QUALITY ASSURANCE

A. Furnish each coarse- aggregate material from single source throughout Work.

1.6 PROTECTION OF UNDERGROUND FACILITIES

A. The Contractor will conduct an investigation to assure that no damage to existing structures, drainage lines, utilities, or conduits will occur.
B. The Contractor is required to use caution when encountering active or abandoned utility structures to avoid possibly disturbing or damaging asbestos-containing materials (ACM), which may be present. The Contractor will notify the Architect of any suspected ACM encountered in Site utility structures and is responsible for arranging testing of the suspect material by polarized light microscopy (PLM) or other approved method before proceeding with any Work that would disturb the structures.
C. While the excavation is open, protect, support, or remove underground installations as necessary.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

2.2 FILL MATERIALS

A. Structural Fill: Type 2A Aggregate as specified in Section 703 of PennDOT Publication 408 Specifications..

1. Suitable On-Site Structural Fill

a. Clean soils without deleterious inclusions.
b. Stratum II or Stratum III Soils as identified in the Geotechnical Report.
c. Optimum Moisture Content:

1) Minimum: 10 percent
2) Maximum: 16 percent

d. Maintained at optimum moisture content (nominally) for compaction as established by ASTM D698.

2. Compaction Criteria (ASTM D698):

a. Foundations: 98 percent.
b. Floor Slabs: 98 percent.
c. Pavements: 95 percent.
d. Berms (non-structural): 93 percent.

2.3 TEMPORARY STEEL PLATES

A. Place temporary steel plates over all saw cuts and trenches in roadway areas that will be subjected to traffic during installations to allow for the passage of vehicular traffic.
B. Design the steel plates to size and thickness capable of supporting HS-20 loading, but not less than one inch thick.
C. Submit design criteria and calculations that determine the sizes to be used to Architect/Engineer for approval.
D. Completely cover the opening with plates and overlap a minimum of 24 inches on all sides.

1. Secure the plates to pavement with spikes or similar devices to prevent any movement of the plates.
2. Place bituminous concrete around the edges of the steel plating to provide a smooth transition on and off the plates for vehicles.
3. When the steel plating is removed, also remove the temporary bituminous concrete.

2.4 GEOTEXTILES

A. Filtration Fabric: Provide to line pipe trenches according to Section 310519.13

"Geotextiles for Earthwork."

B. Erosion Control: Provide erosion control and subsurface drainage geotextile as required for trench Work according to Section 310519.13 "Geotextiles for Earthwork."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Owner's Geotechnical Consultant present, for compliance with requirements for maximum moisture content, installation tolerances compaction and other conditions affecting performance of the Work.
B. Proceed with trench excavation only after unsatisfactory conditions have been corrected.

3.2 LINES AND GRADES

A. Lay pipes and conduit to lines and grades as indicated on Drawings.

1. Architect/Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.3 PREPARATION

A. Call local utility line information service at PA One-Call (800-242-1776) not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.
2. If utilities are to remain in place, provide adequate means of protecting during trench excavation operations.
3. Should uncharted or incorrectly charted piping or other utilities be encountered during trench excavation, consult Architect/Engineer immediately for directions. Cooperate with Architect/Engineer and public utility service companies as required to keep their respective services and facilities in operation. Repair damaged utilities to the satisfaction of utility company.

B. Identify required lines, levels, contours, and datum locations.
C. Protect plant life, lawns, and other features remaining as portion of final landscaping.
D. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
E. Maintain and protect above- and below-grade utilities indicated to remain.
F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.4 TRENCHING

A. Excavate subsoil required for utilities to utility service.
B. Remove lumped subsoil, boulders, and rock more than one (1) cu. yd., measured by volume. Remove larger material as specified in Section 312316.26 "Rock Removal".
C. Perform excavation within 24 inches of existing utility service according to utility's requirements.
D. Do not advance open trench more than 200 feet ahead of installed pipe or conduit.
E. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work according to OSHA 29 CFR 1926.650.
F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe or conduit.
G. Excavate trenches to depth as indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.
H. Do not interfere with 45 -degree bearing splay of trench or foundations.
I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe or conduit. When side walls cannot be sloped, provide sheeting and trench shoring shields to protect excavation as specified in this Section.
J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Owner's Geotechnical Consultant until suitable material is encountered.
K. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
L. Correct over-excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Owner's Geotechnical Consultant.
M. Remove subsoil from Site at no additional cost to Owner.
N. Locate a stairway, ladder, ramp, or other safe means of egress in trench excavations that are 4 feet or more in depth to require no more than 25 feet of lateral travel for personnel.

3.5 SHEETING, SHORING, AND TRENCH SHORING SHIELDS

A. Utilize sheeting, shoring, and trench shoring shields and brace excavations to prevent danger to persons, structures, and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, trench shoring shields, or other protection to maintain stability of excavation.
C. When sheeting is used, drive it ahead of the excavation operations to avoid the loss of material from behind the sheeting. Fill voids that occur outside of the sheeting with gravel borrow, thoroughly compacted.
D. Assemble and place trench shoring shields according to manufacturer's written instructions.
E. Design sheeting and shoring to be removed at completion of excavation Work.
F. Repair damage caused by failure of the sheeting, shoring, trench shoring shields, or bracing and for settlement of filled excavations or adjacent soil.
G. Repair damage to new and existing Work from settlement, water pressure, earth pressure, or other causes resulting from inadequate sheeting, shoring, trench shoring shields, or bracing.

3.6 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.
B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
C. Place material in continuous layers as follows:

    1. Structural Fill: Maximum 8 inches compacted depth.

D. Employ placement method that does not disturb or damage foundation perimeter drainage, utilities in trench, and existing buildings.
E. Maintain optimum moisture content of fill materials to attain required compaction density.
F. Do not leave more than 50 feet of trench open at end of working day.
G. Protect open trench to prevent danger to the public.

3.7 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus or minus **1/2 inch** from required elevations.
B. Top Surface of General Backfilling: Plus or minus 0.10 foot from required elevations.

3.8 FIELD QUALITY CONTROL

A. Owner's Geotechnical Testing Agency shall perform laboratory material tests according to ASTM D698.
B. Owner's Geotechnical Testing Agency shall perform in-place compaction testing according to the following:

    1. Density Tests: ASTM D1556 or ASTM D6938
    2. Moisture Tests: ASTM D6938

C. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.
D. Frequency of Tests: Contractor shall property notify Owner's Geotechnical Testing Agency for tests to be completed at minimum base on the following criteria.

    1. Footing Subgrade:

        a. For each excavated strata of soil on which footings will be placed, Owner's Geotechnical Testing Agency shall perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Owner's Geotechnical Consultant.
        b. The bearing surface is to be evaluated by the Owner's Geotechnical Consultant to confirm that the correct bearing strata has been reached and that the bearing surface is free of loose/soft/disturbed conditions. The

evaluation shall be recorded on the daily field report for each foundation element.

c. Owner's Geotechnical Testing Agency shall perform at least one field density test of the subgrade, backfill or fill for every 50 linear feet of footing, with no fewer than three tests per lift.

2. Building Slabs and Paved Area Subgrade:
3. Utilities:

a. Owner's Geotechnical Testing Agency shall perform one test at each structure and one test for each 50 lineal feet of pipe or fractions thereof per foot of backfill, with no fewer than three tests per lift.

3.9 PROTECTION

A. Reshape and recompact fills subjected to vehicular traffic during construction.

END OF SECTION 31 23 16.13

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SECTION 31 23 16.26 - ROCK REMOVAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-explosive demolition agent.

B. Related Requirements:

1. Section 033000.01 "Cast-in-Place Concrete for Infrastructure."
2. Section 310513 "Soils for Earthwork" for fragmented rock used as special borrow.
3. Section 312213 "Rough Grading."
4. Section 312316 "Excavation" for building excavation.
5. Section 312316.13 "Trenching" for trenching and backfilling for utilities.
6. Section 312319.01 "Dewatering for Infrastructure."
7. Section 312323 "Fill" for backfill materials.
8. Section 312500 "Erosion and Sedimentation Controls."

1.2 DEFINITIONS

A. Fly Rock: The fragments of rock thrown and scattered during blasting.
B. Non-explosive Demolition Agents: A type of expansive grout that is an alternative to explosives and gas pressure blasting products in demolition, mining, and quarrying.
C. Rock: The igneous, metamorphic, and sedimentary rock of size that cannot be removed with one (1) cu. yd. capacity excavator.
D. Site Rock: The solid mineral material with volume exceeding one (1) cu. yd. or solid material that cannot be removed with one (1) cu. yd. capacity excavator without drilling or blasting.
E. Trench Rock: The solid mineral material with volume exceeding one (1) cu. yd. or solid material that cannot be removed with one (1) cu. yd. capacity excavator without drilling or blasting.

1.3 UNIT PRICES

A. Site Rock Removal:

1. Basis of Measurement: By cubic yard measured after removal for excavation of rock.
2. Basis of Payment: Includes preparation of rock for removal, mechanical disintegration of rock, removal from position, loading, and removal from Site. Payment will not be made for over-excavated Work nor for replacement

materials.

B. Trench Rock Removal:

1. Basis of Measurement: By cubic yard measured after removal for rock in trenches.
2. Basis of Payment: Includes preparation of rock for removal, mechanical disintegration of rock, removal from position, loading, and removal from Site. Payment will not be made for over-excavated Work nor for replacement materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1. Review methods and procedures related to blasting procedures and non-explosive demolition, including, but not limited to, the following:

a. Personnel and equipment needed to perform Work and avoid delays.
b. Coordination of Work with utility locator service.
c. Coordination of Work and equipment movement with locations of tree- and plant-protection zones.
d. Protection, monitoring, and surveying procedures.
e. Field quality control.

1.5 SCHEDULING

A. Schedule Work of this Section to avoid disruption to occupied buildings nearby.

1.6 ACTION SUBMITTALS

A. Product Data:

1. Non-explosive demolition agent.

1.7 INFORMATIONAL SUBMITTALS

A. Survey Report: Submit survey report on conditions of buildings or structures near locations of rock removal.

1.8 PROJECT CONDITIONS

A. Prior to rock removal, conduct survey and document conditions of buildings near locations of rock removal and photograph existing conditions and identify existing irregularities.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Owner's Geotechnical Consultant present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Verify Site conditions and note subsurface irregularities affecting Work of this Section.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

A. Excavate and remove rock by mechanical method.

1. Drill holes and use expansive tools wedges non-explosive demolition agent to fracture rock.

B. Cut away rock at bottom of excavation to form level bearing.
C. Remove shale layers to provide sound and unshattered base for footings foundations.
D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
E. Remove excavated rock materials from Site.
F. Correct unauthorized rock removal as directed by Architect and Owner's Geotechnical Consultant.

3.4 FIELD QUALITY CONTROL

A. Request visual inspection of foundation bearing surfaces by Owner's Geotechnical Consultant before installing subsequent Work.

END OF SECTION 31 23 16.26

SECTION 31 23 19 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Construction dewatering.

B. Related Requirements:

1. Section 015723 "Temporary Storm Water Pollution Control" for temporary storm water pollution controls mandated under the EPA's National Pollutant Discharge Elimination System.
2. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.2 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering in accordance with the performance requirements.
2. The geotechnical report is included elsewhere in Project Manual for reference only.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of groundwater and permit excavation and construction to proceed on dry, stable subgrades.

1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing EPA and Pennsylvania Department of Environmental Protection (PADEP) notification regulations including PADEP permitting requirements before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.
D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 311000 "Site Clearing," and Section 312500 "Erosion and Sedimentation Controls" during dewatering operations.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
3. Install erosion and sedimentation control (e.g. stone filters, pumped water filter bag, etc.) at discharge points to prevent accelerated erosion and sedimentation.

B. Place dewatering system into operation to lower water to specified levels before excavating below groundwater level.
C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

1. Owner shall bear no additional costs for the operation of dewatering systems during construction including costs for diesel fuel if required for generators.

B. Operate system to lower and control groundwater to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

C. Discharge and/or dispose of water removed by dewatering legally and in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids accelerated erosion or sedimentation as well as inconvenience to others.
D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of groundwater and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning

properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.
C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.
D. Prepare reports of observations.

3.5 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.
B. Promptly repair damages to adjacent facilities and/or erosion and sedimentation controls caused by dewatering.

END OF SECTION 31 23 19

SECTION 31 23 23 - FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fill materials.
2. Geotextiles.

B. Related Requirements:

1. Section 033000.01 "Cast-in-Place Concrete for Infrastructure" for concrete materials.
2. Section 310513 "Soils for Earthwork" for soils for fill.
3. Section 310516 "Aggregates for Earthwork" for aggregates for fill.
4. Section 310519.13 "Geotextiles for Earthwork" for geotextiles for placement over fill.
5. Section 312213 "Rough Grading" for Site filling.
6. Section 312316 "Excavation" for backfilling of building foundations and utilities within building perimeter.
7. Section 312316.13 "Trenching" for backfilling of utility trenches.
8. Section 313716.13 "Rubble-Stone Riprap" for riprap and rock lining placed loose for soil stabilization and slope protection.
9. Section 329119 "Landscape Grading" for placing, leveling, and compacting topsoil materials prior to final landscaping Work.
10. Section 331416 "Site Water Utility Distribution Piping" for pipe materials, fittings, valves, meters, and backflow preventers.
11. Section 333100 "Sanitary Sewerage Piping" for pipe materials and accessories normally encountered with gravity sanitary building piping.
12. Section 334200.01 "Stormwater Conveyance for Infrastructure" for drainage facilities to collect and provide for flow of stormwater.
13. Document Report of Geotechnical Exploration for Jarrettown Elementary School, dated January 19, 2026, prepared by David Blackmore & Associates, Inc. for geotechnical report, bore-hole locations, and findings of subsurface materials.

1.2 ACTION SUBMITTALS

A. Product Data: For fill materials and geotextiles.
B. Samples:

1. Submit, in airtight containers, one 65-lb. or two (2) five-gallon bucket sample of each type of fill to Owner's Geotechnical Testing Agency for laboratory testing.

1.3 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For imported subsoil.

1. Imported subsoil and topsoil shall meet all PADEP Clean Fill standards with required certifications to be submitted prior to placement of fill.

B. Material Test Reports: For each imported fill materials used, by a qualified testing agency.

1.4 QUALITY ASSURANCE

A. Furnish each coarse- aggregate material from single source throughout Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.
2. Pennsylvania Department of Environmental Protection (PADEP) Clean Fill standards.

2.2 FILL MATERIALS

A. General: Contractor shall import borrow soil materials when sufficient satisfactory soil materials other than structural fill as specified in the Geotechnical Report are not available from on-site excavations at no cost to owner to meet the design grades for the site. Importing structural fill will be paid for in accordance with Contract provisions for unit prices and allowances.
B. Subsoil Fill : Type suitable fill, as specified in the Geotechnical Report.
C. Structural Fill : Type PennDOT 2A Aggregate or On-Site Stratum II or Stratum III Soils, as specified in the Geotech Report .

2.3 GEOTEXTILES

A. Geotextile Fabric : Provide erosion control, subsurface drainage, and soil reinforcement geotextile as required for fill Work according to Section 310519.13 "Geotextiles for Earthwork."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Owner's Geotechnical Consultant present, for compliance with requirements for maximum moisture content, installation tolerances compaction and other conditions affecting performance of the Work.
B. Verify that subdrainage, dampproofing, and waterproofing installations have been inspected.
C. Verify that underground tanks are anchored to their own foundations to avoid flotation after backfilling.
D. Verify structural integrity of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

A. Call local utility line information service at PA One-Call (800-242-1776) not less than three working days before performing Work.

    1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.
C. Protect utilities indicated to remain free from damage.
D. Compact subgrade to specified density requirements for subsequent backfill materials.
E. Soft Subgrade:

    1. Cut out soft areas of subgrade not capable of compaction in place.
    2. If Architect and Geotechnical Testing Agency determine during proof rolling operation that unsatisfactory subgrade soil is present, continue excavation and cut out soft areas at their direction. It shall be the responsibility of the contractor to notify Architect PRIOR to commencing Additional Excavation if the work will result in additional costs to the owner or be credited against a quantity allowance.
    3. Backfill with select structural fill as specified in the Geotechnical Report and compact to density equal to or greater than specified requirements for subsequent fill material.

F. Protect benchmarks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 BACKFILLING

A. Backfill areas to contours and elevations.
B. Systematically backfill to allow maximum time for natural settlement.
C. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces, and do not backfill with frozen materials.
D. Place fill material in continuous layers and compact according to Geotechnical Testing Agency requirements.

E. Maximum Compacted Depths:

1. Place material in continuous layers to following depths:

a. Subsoil Fill: Maximum 8 inches compacted depth.
b. Structural Fill: Maximum 8 inches compacted depth.
c. Granular Fill: Maximum 8 inches compacted depth.

F. Use placement method that does not disturb or damage foundation perimeter drainage, utilities in trench , or existing buildings.
G. Maintain optimum moisture content of fill materials to attain required compaction density.
H. Structures:

1. Backfill against supported foundation walls.
2. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
3. Slope grade away from building minimum 5 percent slope for minimum distance of 10 feet.

I. Make gradual grade changes and blend slope into level areas.
J. Remove surplus backfill materials from Site.

3.4 TOLERANCES

A. Top Surface of Backfilling within Building Areas: Plus or minus 0.10 foot from required elevations.
B. Top Surface of Backfilling under Paved Areas: Plus or minus 0.10 foot from required elevations.
C. Top Surface of General Backfilling: Plus or minus 0.10 foot from required elevations.

3.5 FIELD QUALITY CONTROL

A. Inspections: Request visual inspection of bearing surfaces by Owner's Geotechnical Consultant before installing subsequent Work.
B. Testing:

1. Owner's Geotechnical Testing Agency shall perform laboratory material testing: Comply with ASTM D6938.
2. Owner's Geotechnical Testing Agency shall perform in-place compaction testing:

a. Density Tests: Comply with ASTM D1566/D1566M, or D6938.
b. Moisture Tests: Comply with ASTM D6031/D6031M.

3. If tests indicate that Work does not meet specified requirements, remove Work, replace, compact, and retest.
4. Testing Frequency:

a. Footing Subgrade:

1) For each excavated strata of soil on which footings will be placed, Owner's Geotechnical Testing Agency shall perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Owner's Geotechnical Consultant.
2) The bearing surface is to be evaluated by the Owner's Geotechnical Consultant to confirm that the correct bearing strata has been reached and that the bearing surface is free of loose/soft/disturbed conditions. The evaluation shall be recorded on the daily field report for each foundation element.
3) Owner's Geotechnical Testing Agency shall perform at least one field density test of the subgrade, backfill or fill for every 50 linear feet of footing, with no fewer than three tests per lift.

b. Building Slabs and Paved Areas Subgrade:

1) Owner's Geotechnical Testing Agency shall perform at least one field density test of subgrade for every 2,000 sq. ft. of building slabs and paved area, but in no case fewer than three tests. In each compacted fill layer, perform one field density test for every 1,000 sq. ft. of overlaying paved area, but in no case fewer than three tests.

c. Walls

1) Owner's Geotechnical Testing Agency shall perform one field density test per 50 lineal feet of each side of the wall per foot of backfill or fill, with no fewer than three tests per lift.

d. Utilities

1) Owner's Geotechnical Testing Agency shall perform one test at each structure and one test for each 50 lineal feet of pipe or fractions thereof per foot of backfill, with no fewer than three tests per lift.

e. Grass

1) Owner's Geotechnical Testing Agency shall perform testing at same frequency as specified for building slabs and paved areas.

5. Proof-roll compacted fill surfaces under slabs on grade, pavers, paving, and sidewalks.

3.6 PROTECTION

A. Reshape and recompact fills subjected to vehicular traffic during construction.

END OF SECTION 31 23 23

SECTION 31 23 23.33 - FLOWABLE FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flowable fill.
2. Mixes.

B. Related Requirements:

1. Section 312316 "Excavation" for general building excavation.
2. Section 312316.13 "Trenching" for soil and aggregate backfill for utility trenches.
3. Section 312323 "Fill" for soil and aggregate backfill for structures.
4. Section 329119 "Landscape Grading" for filling of topsoil over backfilled trenches to finish grade elevation.
5. Section 331413 "Public Water Utility Distribution Piping" for public water distribution systems.
6. Section 333100 "Sanitary Sewerage Piping" for sanitary sewer piping and bedding from building to connection to existing sanitary sewer.
7. Section 334200.01 "Stormwater Conveyance for Infrastructure" for gravity storm drain piping from building to municipal utility or other discharge system.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Flowable fill.
2. Mixes.

1.4 INFORMATIONAL SUBMITTALS

A. Submit manufacturer's specifications, catalog cuts, and other engineering data needed to demonstrate compliance with specified requirements.

1. Submit manufacturer's literature and specifications for compression testing machine package to determine strength of flowable fill. The literature must detail testing machine features, including all required accessories to perform

compression strength test of flowable fill according to ASTM C495/C495M or LCCF according to ASTM C796/C796M.

2. Submit test report for proposed flowable fill mix design, verifying that mix design conforms to specified flowable fill properties.

    a. Test proposed flowable fill mix according to these specifications and ASTM requirements specified herein.
    b. Furnish certification that flowable fill material fully conforms to specification requirements.
    c. Include, at minimum, the following information in test report for proposed flowable fill mix:

        1) Total gallons of water per cubic yard.
        2) Brand, type, composition, and quantity of cement.
        3) Brand, type, ASTM designation, lot number, and quantity of foaming agent.
        4) Cast wet density.
        5) Oven dry density.
        6) Water absorption, percent of volume.
        7) Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture, when used.
        8) Foam volume for LCCF.
        9) Compressive strength based on 7-day and 28-day compression tests.
        10) Water-cement ratio.
        11) Freeze-thaw resistance.
        12) Coefficient of permeability at confining stresses of 2 psi and 8 psi.
        13) Loss of air during pumping and air content before and after pumping.
        14) Density of preformed foam.
        15) Foam generation and other equipment used and foam discharge rate.
        16) Mixing times and temperature of water used.

3. Submit daily field reports and all test results of flowable fill.

1.5 QUALITY ASSURANCE

A. Furnish portland cement, foaming agent, and each fine- aggregate material from single source throughout Work.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Minimum Conditions: Do not install flowable fill during inclement weather or when ambient temperature is less than 40 degrees F.

1.7 FIELD MEASUREMENTS

A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

2.2 FLOWABLE FILL

A. Provide excavatable type and non-excavatable type consisting of the following material and admixture components:

1. Portland Cement: ASTM C150/C150M Type I - Normal; manufactured by concrete plant listed in PennDOT Bulletin 15 .
2. Fine Aggregates: Sand conforming to the requirements of PennDOT Publication 408 - Section 703.1, Type A Concrete Sand.
3. Water: Potable and free from deleterious amounts of alkali, acid, and organic materials that would adversely affect setting time or strength of LCCF.

B. Admixtures:

1. Manufacturers:

a. BASF
b. Sika Corporation
c. W.R. Meadows, Inc

2. Air Entrainment: AASHTO M 154 from a manufacturer listed in Bulletin 15 specifically for flowable fill.
3. Chemical Admixture: AASHTO M 194 .

4. Fly Ash: According to ASTM C618 Class C or F and obtained from residue of electric generating plant using ground or powdered coal.

2.3 MIXES

A. Mix and deliver flowable fill according to ASTM C94/C94M, Option C.
B. Flowable Fill Design Mix (Per PennDOT Publication 408, Section 220, Table A:

1. Cement Content:

a. Excavatable: 40 to 100 lb./cu. yd.
b. Non-excavatable: 100 to 200 lb./cu. yd.

2. Fine Aggregate:

a. Excavatable: 2,600 lb./cu..
b. Non-excavatable: 2,600 lb./cu. .

3. Fly Ash Content:

a. Excavatable: 300 lb./cu. yd. .
b. Non-excavatable: 300 lb./cu. yd. .

4. Water Content:

a. Excavatable: As required.
b. Non-excavatable: As required.

5. Air Entrainment:

a. Excavatable: 5 to 35 percent.
b. Non-excavatable: 5 to 15 percent.

6. Slump:

a. Excavatable: 7 inches minimum
b. Non-excavatable: 7 inches minimum

7. 28-Day Compressive Strength:

a. Excavatable: Maximum 125 psi max .
b. Non-excavatable: Minimum 500 psi max .

8. Temperature, Minimum, at Point of Delivery:

a. Excavatable: 50 degrees F.
b. Non-excavatable: 50 degrees F.

C. Provide adequate water content in design mix to produce self-leveling, flowable fill material at time of placement.
D. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.

2.4 SOURCE QUALITY CONTROL

A. Testing: Test and analyze properties of flowable fill design mix and certify results for the following:

1. Design mix proportions by weight of each material.

2. Aggregate: ASTM C33/C33M for material properties and gradation.
3. Properties of plastic flowable fill design mix including:

    a. Temperature.
    b. Slump.
    c. Air entrainment.
    d. Wet unit mass.
    e. Yield.
    f. Cement factor.
    g. Foam content.

4. Properties of hardened flowable fill design mix including:

    a. One-day, seven-day, and 28-day compressive strength. Report compressive strength of each specimen and average specimen compressive strength.
    b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

B. Prepare delivery tickets containing the following information:

1. Project designation.
2. Date.
3. Time.
4. Class and quantity of flowable fill.
5. Actual batch proportions.
6. Free moisture content of aggregate.
7. Quantity of water withheld.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions , with Installer present, and, Owner's Geotechnical Consultant for compliance with requirements for maximum moisture content, installation tolerances compaction and other conditions affecting performance of the Work.
B. Verify utility installation is complete and tested before placing flowable fill.
C. Verify excavation is dry .

3.2 PREPARATION

A. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.
B. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.
C. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION OF FLOWABLE FILL

A. Architect/Engineer approval required for the condition of subgrade and method of placement.
B. Remove all debris and foreign matter from the excavation before depositing flowable fill.
C. Place flowable fill by chute, pumping or other methods approved by Owner's Geotechnical Consultant.
D. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.
E. Place flowable fill evenly on both sides of utilities to maintain alignment.
F. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Perform inspection and testing according to ASTM C94/C94M.

    1. Take samples for tests for every 50 cu. yd. of flowable fill, or fraction thereof, installed each day.
    2. Sample, prepare, and test four compressive strength test cylinders according to ASTM D4832. Test one specimen at three days, one at seven days, and two at 28 days.
    3. Measure temperature at point of delivery when samples are prepared.
    4. Perform in-place penetration (density) tests using handheld penetrometer to measure penetration resistance of hardened flowable fill according to ASTM C403.
    5. Perform tests at locations as directed by Architect/Engineer.

C. Perform in-place density tests using nuclear test device according to ASTM C1040/C1040M.

    1. Perform tests at locations as directed by Architect/Engineer.

D. Defective Flowable Fill: Either fill type failing to meet the following test requirements or fill delivered without the following documentation:

    1. Test Requirements:

        a. Minimum temperature at point of delivery.
        b. Compressive strength requirements for each type of fill.

    2. Documentation: Duplicate delivery tickets.

3.5 CLEANING

A. Remove spilled and excess flowable fill from Project Site.
B. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION 31 23 23.33

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SECTION 31 25 00 - EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rock materials.
2. Planting materials.
3. Pipe materials.
4. Stabilized construction entrances.
5. Siltation control devices.
6. Erosion control devices.
7. Anchoring devices.
8. Accessories.

B. Related Requirements:

1. Section 310513 "Soils for Earthwork."
2. Section 310516 "Aggregates for Earthwork."
3. Section 311000 "Site Clearing."
4. Section 312316 "Excavation."
5. Section 312316.13 "Trenching."
6. Section 312323 "Fill."
7. Section 313716.13 "Rubble-Stone Riprap."
8. Section 321313 "Concrete Paving."
9. Section 329113 "Soil Preparation."
10. Section 329119 "Landscape Grading."
11. Section 329219 "Seeding."
12. Section 334213 "Stormwater Culverts."

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1. Meet with Owner, Architect, Construction Manager, Engineer, Township Engineer, County Conservation District, and earthwork subcontractor.

B. Convene minimum one week prior to commencing Work of this Section.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Rock materials.
2. Stabilized construction entrances.
3. Erosion control devices.
4. Anchoring devices.
5. Accessories.

1.4 QUALITY ASSURANCE

A. Perform Work according to requirements of Section 310513 "Soils for Earthwork," Section 310516 "Aggregates for Earthwork," Section 311000 "Site Clearing," Section 312316 "Excavation," Section 312323 "Fill," Section 321313 "Concrete Paving," Section 329119 "Landscape Grading," Section 329113 "Soil Preparation," Section 329219 "Seeding," Section 313716.13 "Rubble-Stone Riprap," Section 334213 "Stormwater Culverts,".
B. Perform Work according to Pennsylvania Department of Environmental Protection standards.
C. Progress Schedule:

1. Clearly outline intended maintenance of traffic, locations where temporary and permanent soil erosion and sediment control measures will be installed, and such other information as required.
2. Provide special consideration to sensitive areas such as wetlands and waterways.
3. Incorporate appropriate staging and seasonal constraints to maximize the effectiveness of the soil erosion and sediment controls.
4. Indicate when Work is restricted in these sensitive areas as outlined in permits issued by regulatory agencies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. Pennsylvania Department of Environmental Protection standards.
2. County Conservation District standards.

2.2 ROCK MATERIALS

A. Furnish materials according to Pennsylvania Department of Environmental Protection.
B. Rock, Option 1:

1. As specified in Section 313716.13 "Rubble-Stone Riprap."

2.3 PLANTING MATERIALS

A. Seeding and Soil Supplements:

1. Grass Seed as specified in Section 329219 "Seeding".

B. Mulch:

1. Organic Mulch as specified in Section 329300 "Plants".

2.4 PIPE MATERIALS

A. Pipe:

1. HDPE as specified in Section 334200 "Stormwater Conveyance".
2. Furnish according to State of Pennsylvania Department of Transportation, Publication 408 Standards.

2.5 STABILIZED CONSTRUCTION ENTRANCES

A. Stone Size: Use crushed stone as specified in the CONSTRUCTION DETAILS as indicated on the Drawings.
B. Length: As effective, but not less than indicated on the Drawings.
C. Thickness: Not less than indicated on the Drawings.
D. Width: Not less than full width of all points on ingress or egress, minimum 20 feet wide.
E. Washing: When necessary, clean wheels to remove sediment prior to entrance onto public right-of-way. When washing is required, provide an area stabilized with crushed stone that drains into an approved sediment trap or sediment basin. Prevent all sediment from entering any storm drain, ditch, or watercourse by using sandbags, gravel boards, or other approved methods.
F. Maintenance: Maintain entrance in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair or cleanout of any measures used to trap sediment. All sediment spoiled, dropped, washed, or tracked onto public rights-of-way must be removed immediately.

2.6 SILTATION CONTROL DEVICES

A. Filter Socks:

1. Manufacturers:

a. MWI Environmental (Mulch Works)
b. Filtrexx International/MKB Company
c. L & M Supply; Core & Main LP

2. Provide filter socks consisting of a three-dimensional matrix of certified,

composted organic material or other organic matter to create a filter medium. Fill the tubular mesh sock with organic filter material of wood chips or mulch that has been screened to remove fines, crushed stone, or gravel. Use crushed stone or gravel when the sock will be used on paved areas where the sock cannot be staked in place. Fill the sock with organic material by blowing the material into the tube with a special pneumatic blower truck or similar device. Hand filling with organic material is not an acceptable means to fill the tube as the material cannot be compacted in the sock.

3. Performance and Design Criteria:

    a. Mesh Material Type: Multi-filament polypropylene (MFPP) photodegradable.
    b. Uses: Standard sediment control applications.
    c. Mesh Opening Size: 1/8 inch.
    d. Available Diameters: 8 inches 12 inches 18 inches 24 inches and 32 inches.
    e. Functional Longevity/Project Duration: Up to five years.
    f. Tensile Strength: MD - 670 lb., TD - 423 lb.
    g. Locally sourced filter media.
    h. Mesh Color: Green or Black.

2.7 EROSION CONTROL DEVICES

A. Erosion Control Blankets:

1. Basis-of-Design Product: Provide Western Green; EroNet S75 or EroNet S150 and relevant technical details including physical, functional, or performance characteristics of the named product that an "equal" item must meet to be deemed acceptable from one of the following:

    a. American Excelsior Company
    b. North American Green
    c. Western Excelsior Company

2. 100 percent agricultural straw fiber matrix, 0.5 lb./sq. yd., stitch bonded with degradable thread between two photodegradable polypropylene nettings.
3. Securement: Staples used to anchor erosion control blankets should be U-shaped, 11-gage or heavier steel wire, having a span width of 1 inch and a length of 6 inches or more from top to bottom after bending.

2.8 ANCHORING DEVICES

A. Staples: Must be No. 8 gage steel wire, bent U-shapes with throat width equal to 1 to 2 inches, and effective driving depth of 6 inches or as suggested by the manufacturer.
B. Sandbags: Must be of proper size to temporarily stabilize fabric; number and weight sufficient to withstand wind speeds of 50 mph.

2.9 ACCESSORIES

A. Steel Plate Anti-vortex Device:

1. Anti-Vortex device as specified in Section STANDARD CONSTRUCTION DETAIL #7-5 - TRASH RACK AND ANTI-VORTEX DEVICE as indicated on the Drawings.
2. Furnish according to Pennsylvania Department of Environmental Protection Standards.

B. Anti-seep Collar:

1. Furnish according to Pennsylvania Department of Environmental Protection Erosion and Sediment Pollution Control Program Manual, Technical Guidance Number 386-2134-001..

C. Trash Rack:

1. Bars welded to angles and at each intersection of bars as specified in Section on PADEP STANDARD CONSTRUCTION DETAIL #7-5 - TRASH RACK AND ANTI-VORTEX DEVICE as indicated on the Drawings..
2. Furnish according to Pennsylvania Department of Environmental Protection Erosion and Sediment Pollution Control Program Manual, Technical Guidance Number 386-2134-001..

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Owner's Geotechnical Consultant , with Installer present, for compliance with requirements for maximum moisture content, installation tolerances compaction and other conditions affecting performance of the Work.
B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.
C. Verify gradients and elevations of base or foundation for other Work are correct.

3.2 INSTALLATION OF ROCK MATERIALS

A. Installation of Rock Energy Dissipator:

1. Excavate to indicated depth of rock lining or nominal placement thickness. Remove loose, unsuitable material below bottom of rock lining, then replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface.

a. Nominal Placement Thickness per National Crushed Stone Association

(NCSA), Class:

1) R8: 48 inches.
2) R7: 36 inches.
3) R6: 30 inches.
4) R5: 24 inches.
5) R4: 18 inches.
6) R3: 12 inches.

2. Lay and overlay geotextile fabric over substrate. Lay fabric parallel to flow from upstream to downstream. Overlap edges upstream over downstream and upslope over downslope. Provide a minimum overlap of 3 feet. Offset adjacent roll ends a minimum of 5 feet when lapped. Cover fabric as soon as possible and in no case leave fabric exposed more than four weeks.
3. Carefully place rock on filtration geotextile fabric to produce an even distribution of pieces, with minimum of voids and without tearing geotextile.
4. Unless indicated otherwise, place full course thickness in one operation to prevent segregation and to avoid displacement of underlying material. Arrange individual rocks for uniform distribution.

3.3 INSTALLATION OF STABILIZED CONSTRUCTION ENTRANCES

A. Construct entrance with minimum of 8 inches of coarse aggregate at all points of ingress and egress.
B. Width: Minimum 20 feet, increased as needed for typical construction vehicles.
C. Minimum Length: As indicated on the Drawings .
D. Install filter fabric below aggregate.
E. Maintain entrance throughout construction, adding more aggregate or increasing length as needed.

3.4 INSTALLATION OF FILTER SOCKS

A. Position filter socks as indicated and as necessary to prevent off-site movement of sediment produced by construction activities as directed by the Architect/Engineer.

1. Install erosion control measures around all existing catch basins within the Project limits and in the adjacent affected areas, or as determined by the Architect/Engineer in the field.

B. Install stakes through the middle of the sediment control on minimum 10-foot centers. Depth of staking must be 12 inches for sand or silt and 8 inches for clay soils.
C. Install filter socks, as indicated, and stake as required.
D. Furnish, place, and maintain filter socks as specified and as shown. Remove upon completion of all Work.

3.5 STABILIZATION OF SITE

A. Incorporate erosion control devices indicated into the Project at the earliest practicable time possible.
B. Construct, stabilize, and activate erosion controls before Site disturbance within tributary areas of those controls.
C. Stockpile and waste pile heights must not exceed 35 feet. Slope stockpile sides at 2:1 or flatter.
D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than four (4) days.

E. Stabilize diversion channels, sediment traps, and stockpiles immediately.
F. Installation of Diversion Channel:

1. Windrow excavated material on low side of channel.
2. Compact to 95 percent maximum density.
3. On entire channel area, apply soil supplements and sow seed as specified in Section 329113 "Soil Preparation" and Section 329219 "Seeding."
4. Install Work according to Pennsylvania Department of Environmental Protection (PADEP) Standards.

G. Installation of Sedimentation Pond:

1. Clear and grub storage area and embankment foundation site as specified in Section 311000 "Site Clearing."
2. Excavate key trench for full length of dam. Excavate emergency spillway in natural ground.
3. Install pipe spillway, with anti-seep collar attached, at location indicated.
4. Place riser with trash rack and anti-vortex device . Construction of embankment and trench prior to placing pipe is not required.
5. Do not use coarse aggregate as backfill material around pipe. Backfill pipe with suitable embankment material to prevent dam leakage along pipe.
6. Construct rock basin at outlet end of pipe as specified in this Section. Place embankment material as specified in Section 312323 "Fill." When required, obtain borrow excavation for formation of embankment as specified in Section 312323 "Fill."
7. On entire sedimentation pond area, apply soil supplements and sow seed as specified in Section 329113 "Soil Preparation" and Section 329219 "Seeding."
8. Mulch seeded areas with hay as specified in Section 329113 Soil Preparation" and Section 329219 "Seeding."
9. Install Work according to Pennsylvania Department of Environmental Protection (PADEP) standards.

H. Installation of Sediment Trap:

1. Clear Site as specified in Section 311000 "Site Clearing."
2. Construct trap by excavating and forming embankments as specified in Section 312316 "Excavation" and Section 312323 "Fill."
3. Place coarse aggregate or rock at outlet as indicated on Drawings.
4. Place geotextile fabric as specified for rock energy dissipator.

5. When required, obtain borrow excavation for formation of embankment as specified in Section 312316 "Excavation."
6. On entire sediment trap area, apply soil supplements and sow seed as specified in Section 329113 "Soil Preparation" and Section 329219 "Seeding."
7. Mulch seeded areas with hay as specified in Section 329113 "Soil Preparation" and Section 329219 "Seeding."
8. Install Work according to Pennsylvania Department of Environmental Protection (PADEP) Standards.

3.6 FIELD QUALITY CONTROL

A. Inspect erosion control devices on a weekly basis and after each runoff event per Pennsylvania Department of Environmental Protection (PADEP) requirements. Make necessary repairs to ensure erosion and sediment controls are in good working order.
B. Prepare inspection reports.

3.7 CLEANING

A. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.
B. Do not damage structure or device during cleaning operations.
C. Do not permit sediment to erode into construction or Site areas or natural waterways.
D. Clean channels when depth of sediment reaches approximately one-half channel depth.

END OF SECTION 31 25 00

SECTION 31 37 16.13 - RUBBLE-STONE RIPRAP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Riprap rock.
2. Filtration geotextile.

B. Related Requirements:

1. Section 310519.13 "Geotextiles for Earthwork" for reinforcement barrier.
2. Section 312213 "Rough Grading" for removal of topsoil and filling associated with contouring of Site.
3. Section 312316 "Excavation" for excavating for riprap.
4. Section 312316.13 "Trenching" for trenching and backfilling for Site utilities.
5. Section 312323 "Fill" for backfilling as required at building perimeter and Site structures.
6. Section 312500 "Erosion and Sedimentation Controls" for filtration fabric placed below riprap.
7. Section 334213 "Stormwater Culverts" for excavating, bedding, and backfilling requirements for stormwater culverts and accessories.

1.2 DEFINITIONS

A. NCHRP: National Cooperative Highway Research Program.
B. NCSA: National Crushed Stone Association.
C. Riprap: A relatively thin layer of large, durable, approximately equidimensional rock fragments or blocks placed on bedding to dissipate water energy and protect a slope, channel bank, or shore from erosion caused by runoff, currents, waves, or ice.
D. Rubble Riprap: A type of riprap that includes rock spoils, broken concrete, and steel furnace slag. Its quality is dependent on its shape, specific weight, gradation, and durability (resistance to weathering).

1.3 COORDINATION

A. Coordinate Work of this Section with rough grading, excavating, utilities , and stormwater installation Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

A. Furnish riprap stone and filter, bedding, stone, and spall material from single source throughout Work of this Section.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.
2. Pennsylvania Department of Environmental Protection (PADEP) standards.

2.2 MATERIALS

A. Riprap Rock:

1. Granite Limestone type; broken stone irregularly shaped rock; solid and nonfriable .

B. Rock: Sound, hard, and angular shape; well graded, without shale seams, structural defects, and foreign substances; with width and thickness greater than one-third its length; minimum specific gravity of 2.5, as determined according to PennDOT Publication 408 Specifications - Section 850 , bulk saturated, and surface dry basis; minimum durability determined by petrographic examination; size and gradation according to NCSA Class, Size No. R8 R7 R6 R5 R4 R3 within following limits:

1. Percent Passing per NCSA Size No. and Square Opening Size:

a. R8:

1) 42 Inches (1 066 mm): 100.
2) 24 Inches (610 mm): 15 to 50.
3) 15 Inches (380 mm): Zero to 15.

b. R7:

1) 30 Inches (762 mm): 100.
2) 18 Inches (460 mm): 15 to 50.
3) 12 Inches (300 mm): Zero to 15.
4) 6 Inches (150 mm): Zero to 15.

c. R6:

1) 24 Inches (610 mm): 100.
2) 12 Inches (300 mm): 15 to 50.

3) 6 Inches (150 mm): Zero to 15.

d. R5:

1) 18 Inches (460 mm): 100.
2) 9 Inches (225 mm): 15 to 50.
3) 4 Inches (100 mm): Zero to 15.

e. R4:

1) 12 Inches (300 mm): 100.
2) 6 Inches (150 mm): 15 to 50.
3) 3 Inches (75 mm): Zero to 15.

f. R3:

1) 6 Inches (150 mm): 100.
2) 3 Inches (75 mm): 15 to 50.
3) 2 Inches (50 mm): Zero to 15.

C. Furnish rock riprap materials according to Pennsylvania Department of Transportation (PennDOT) standards.
D. Filtration Geotextile:

1. Adequately strong to withstand installation stresses during placement. Provide recommended geotextile properties for survival during construction according to AASHTO M 288 and as specified in Section 312500 "Erosion and Sedimentation Controls".
2. Furnish according to Pennsylvania Department of Transportation (PennDOT) standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Owner's Geotechnical Consultant present, for compliance with requirements for maximum moisture content, installation tolerances , compaction, and other conditions affecting performance of the Work.
B. Verify compacted subgrade and installation of filtration geotextile fabric is acceptable and ready to accept riprap stone or rubble riprap and imposed loads.
C. Verify gradients and elevations of base or foundation for riprap Work are correct.

3.2 APPLICATION OF FILTRATION GEOTEXTILE

A. Place filtration geotextile over substrate as specified in Section 312500 "Erosion and Sedimentation Controls" and according to ASTM D6825.
B. Avoid or resolve issues related to placement of riprap rock on filtration geotextiles,

which include the following:

1. Survivability of the fabric.
2. Clogging potential of the geotextile.
3. Seam overstress or displacement of overlaps.

C. For all installations, place geotextile without wrinkles or folds on a smooth graded surface in intimate contact with the soils.
D. For installations where filtration is critical, riprap rock should be placed on a cushion layer of bedding material. Direct sunlight will degrade the underlying bedding or geotextile; therefore, it should not be visible.

3.3 APPLICATION OF RIPRAP ROCK

A. Place riprap rock on prepared slopes or areas to produce a well-graded mass of stone with minimum practicable percentage of voids.
B. Place the entire mass of stone to lines, grades, and full thickness shown on the plans and according to Pennsylvania Department of Environmental Protection (PADEP) standards in one operation. Distribute the larger stones evenly and provide the entire mass of stone conforming to the gradation specified by the Architect/Engineer. Place and distribute all riprap protection so there will be no significant accumulations of either the larger or smaller sizes of stone.
C. Do not place riprap rock in layers or by dumping into chutes or other similar methods likely to cause segregation. Place riprap in a manner that produces an interlocked, well-graded mass of rock and avoids displacing the underlying material. Direct sunlight will degrade the underlying bedding or geotextile; therefore, it should not be visible.
D. On slopes, place riprap rock at the bottom and work toward the top of the slope to prevent rolling or segregation.
E. Place riprap rock at culvert pipe ends.
F. Place riprap rock where indicated on Drawings or as directed by Architect/Engineer.
G. Place riprap rock into position and remove foreign material from surfaces.
H. Do not place riprap rock over frozen or spongy subgrade surfaces.
I. Average Installed Thickness:

1. As indicated on Drawings or as directed by Architect/Engineer.

END OF SECTION 31 37 16.13

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SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes temporary excavation support and protection systems.
B. Related Requirements:

1. Section 013233 "Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
2. Section 312000 "Earth Moving" for excavating and backfilling, for controlling surface-water runoff and ponding, and for dewatering excavations.

1.2 ACTION SUBMITTALS

A. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.
2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.
3. Indicate type and location of waterproofing.
4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

B. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Professional Engineer: Experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in the state in which Project is located.

B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage

caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

1.4 CLOSEOUT SUBMITTALS

A. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.5 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility-serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than five (5) days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Construction Manager's written permission.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks, and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design excavation support and protection systems to resist all lateral loading and surcharge, including but not limited to, retained soil, groundwater pressure, adjacent building loads, adjacent traffic loads, construction traffic loads, material stockpile loads, and seismic loads, based on the following:

1. Compliance with OSHA Standards and interpretations, 29 CFR 1926, Subpart P.
2. Compliance with AASHTO Standard Specification for Highway Bridges or AASHTO LRFD Bridge Design Specification, Customary U.S. Units.
3. Compliance with requirements of authorities having jurisdiction.
4. Compliance with utility company requirements.

2.2 MATERIALS

A. Provide materials that are either new or in serviceable condition.
B. Structural Steel: ASTM A36/A36M, ASTM A690/A690M, or ASTM A992/A992M.

C. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.
D. Shotcrete: Comply with Section 033713 "Shotcrete" for shotcrete materials and mixes, reinforcement, and shotcrete application.
E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
F. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
G. Tiebacks: Steel bars, ASTM A722/A722M.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

3.2 INSTALLATION - GENERAL

A. Locate excavation support and protection systems clear of permanent construction, so that construction and finishing of other work is not impeded.
B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.

3.3 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation.

1. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement.
2. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging.
3. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds.

1. Trim excavation as required to install lagging.
2. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.4 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.
B. Accurately place the piling using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer.

1. Limit vertical offset of adjacent sheet piling to 60 inches.
2. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

C. Cut tops of sheet piling to uniform elevation at top of excavation.

3.5 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
2. Install internal bracing if required to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 MAINTENANCE

A. Monitor and maintain excavation support and protection system.
B. Prevent surface water from entering excavations by grading, dikes, or other means.
C. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

3.7 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open.

1. Maintain an accurate log of surveyed elevations and positions for comparison

with original elevations and positions.
2. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.8 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures.

1. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
2. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."
3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 31 50 00

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SECTION 32 05 13 - SOILS FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subsoil materials.
2. Topsoil materials.

B. Related Requirements:

1. Section 310513 "Soils for Earthwork."
2. Section 312213 "Rough Grading."
3. Section 312316.13 "Trenching."
4. Section 312323 "Fill" for backfilling as required at building perimeter and Site structures to subgrade elevations.
5. Section 312500 "Erosion and Sedimentation Controls" for slope protection and erosion control.
6. Section 313716.13 "Rubble-Stone Riprap " for riprap and rock lining placed loose for soil stabilization and slope protection.
7. Section 320516 "Aggregates for Exterior Improvements" for coarse- and fine-aggregate materials.
8. Section 329119 "Landscape Grading" for placing, leveling, and compacting topsoil materials prior to final landscaping Work.
9. Section 329219 "Seeding" for fertilizing, seeding, hydroseeding, mulching, and maintenance.
10. Section 329223 "Sodding" for preparation of subsoil, placement of topsoil, fertilization, sod installation, and maintenance.
11. Section 329300 "Plants" for preparation of subsoil and topsoil, topsoil bedding, trees, plants, ground cover, mulch, fertilizer, pruning, and maintenance.
12. Document Report of Geotechnical Exploration for Jarrettown Elementary School dated January 19, 2026. prepared by David Blackmore and Associates, Inc. for geotechnical report, bore hole locations, and findings of subsurface materials.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Subsoil materials.
2. Topsoil materials.

B. Samples: Submit, in airtight containers, 65-lb. or two (2) five-gallon bucket sample of each type of imported fill to testing laboratory.

C. Materials Source: Submit name of imported materials' source.

1.3 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For subsoil and topsoil materials.

1. Imported subsoil and topsoil shall meet all PADEP Clean Fill standards with required certification to be submitted prior to placement of fill.

1.4 QUALITY ASSURANCE

A. Furnish each subsoil and topsoil material from single source throughout Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work in accordance with:

1. The State of Pennsylvania Department of Transportation standards.

2.2 SUBSOIL MATERIALS

A. Imported and on-site subsoil borrow material shall be suitable soil approved for specific use on the site by the owner's geotechnical representative in accordance with the geotechnical report. Subsoil as specified in the Geotechnical Report.

2.3 TOPSOIL MATERIALS

A. Topsoil: All stockpiled shall be used for all lawn areas. In the event there is a shortage of stockpiled topsoil the Contractor shall import topsoil at their expense.

1. Imported topsoil shall be screened and be natural, fertile, friable loam or sandy loam as classified by the U. S. Department of Agriculture Soil Classification system, and typical of the cultivated topsoil of locality. The soil shall contain not less than 1% or more than 8% by weight, of decayed organic matter (humus), as determined by ASTM F 1647. The topsoil shall be taken from a well-drained, arable site, free from sub-soil, large stones greater than ½ inch or ¼ inch (if for athletic use), earth clods, sticks, stumps, clay lumps, roots, or other objectionable, extraneous matter of debris. Topsoil shall also be free of Quackgrass rhizomes, Agropyron Repens, and the nut-like tubers of Nutgrass, Cyperus Esculentus, and all other primary noxious weeds. Topsoil shall not have a pH of less than 6.0 or greater than 7.5. Topsoil shall not be delivered or used for planting while in a frozen or muddy condition. The topsoil shall be approved by the Architect prior to use and after reviewing a test report.

a. Topsoil shall conform to the following particle size distribution, as

determined by pipette method in compliance with ASTM F1632.

1) Sand (22 to 2 mm): 40% to 60%.
2) Silt (23 to 0.05 mm) - 30% to 40%.
3) Clay (<0.002 mm) - 10% to 20%.
4) Gravel (>2.0 mm) - <15%.

b. All topsoil whether from onsite sources or imported shall have a maximum stone size of shall be 1/2 inches largest diameter. Topsoil whether from onsite sources or imported for use on practice or competition playing fields shall have a maximum stone size limited to ¼ inch.

1) If organic amendments are needed to obtain the specified organic matter content of the topsoil, the organic matter source may be a peat or compost material. The peat shall be Canadian sphagnum peat having an ash content not exceeding 15%, as determined by ASTM D 2974. Composts may be used, provided that the material has been composted in an in-vessel system and has an ash content not exceeding 40%, and is screened to 1/4 inch.

c. In the event there is a surplus of stockpiled topsoil then the Contractor shall deposit and spread the topsoil to a maximum depth of 8 inches as directed by the Architect. Surplus topsoil shall not be removed from the site unless directed by the Architect and authorized by the owner and approved by the municipality.

2.4 SOURCE QUALITY CONTROL

A. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698.
B. When tests indicate materials do not meet specified requirements, change material and retest.
C. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Owner's Geotechnical Consultant present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting performance of the Work.

3.2 INSTALLATION OF SUBSOIL AND TOPSOIL MATERIALS

A. Excavation:

1. Excavate subsoil materials and topsoil materials from areas designated. Strip

topsoil to full depth of topsoil in designated areas.
2. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.
3. Remove excess excavated subsoil materials not intended for reuse from Site.
4. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from Site.

B. Stockpiling:

1. Stockpile materials on Site at locations indicated.
2. Stockpile in sufficient quantities to meet Project schedule and requirements.
3. Separate differing materials with dividers or stockpile apart from each other.
4. Stockpile topsoil **35 feet** high maximum.
5. Prevent intermixing of soil types or contamination.
6. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 CLEANING

A. Remove stockpile and leave area in clean and neat condition.
B. Grade Site surface to prevent freestanding surface water.
C. Fine grade, topsoil and re-seed stockpile area as applicable.

END OF SECTION 32 05 13

SECTION 32 05 16 - AGGREGATES FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse aggregate materials.

B. Related Requirements:

1. Document Report of Geotechnical Exploration for Jarrettown Elementary School dated January 19, 2026. prepared by David Blackmore and Associates, Inc. for geotechnical report, borehole locations, and findings of subsurface materials.
2. Section 310516 "Aggregates for Earthwork" for granular fill, topsoil, and grading materials.
3. Section 312213 "Rough Grading."
4. Section 312316.13 "Trenching."
5. Section 312323 "Fill."
6. Section 312500 "Erosion and Sedimentation Controls" for slope protection and erosion control.
7. Section 313716.13 "Rubble-Stone Riprap."
8. Section 320513 "Soils for Exterior Improvements" for fill and grading materials.
9. Section 321123 "Aggregate Base Courses."
10. Section 321413 "Precast Concrete Unit Paving."
11. Section 321416 "Brick Unit Paving."
12. Section 329119 "Landscape Grading."
13. Section 331416 "Site Water Utility Distribution Piping."
14. Section 333100 "Sanitary Sewerage Piping."
15. Section 334200.01 "Stormwater Conveyance for Infrastructure."
16. Section 312000 "Earth Moving" for subbase preparation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1.3 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For coarse and fine aggregate materials.

1.4 QUALITY ASSURANCE

A. Furnish each coarse aggregate material from single source throughout Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work in accordance with:

1. The State of Pennsylvania Department of Transportation standards.

2.2 COARSE AGGREGATE MATERIALS

A. All imported coarse aggregate shall meet the requirements of Per PennDOT Publication 408 Specifications, current edition. On-site borrow aggregate shall meet the performance characteristics as determined and documented/approved by the geotechnical engineer in the geotechnical report as well as the owner's geotechnical field representative during construction.

1. Type AASHTO #57 Stone: Comply with PennDOT Publication 408, Section 703.2, Table C:

   a. Percent Passing According to Sieve Size:

      1) 1-1/2 inches (37.5 mm): 100.
      2) 1 inch (25 mm): 95 to 100.
      3) 1/2 inch (12.5 mm): 25 to 60.
      4) No. 4 (4.75 mm): 0 to 10.
      5) No. 8 (2.36 mm): 0 to 10.

2. Type AASHTO #8 Stone: Comply with PennDOT Publication 408, Section 703.2, Table C:

   a. Percent Passing According to Sieve Size:

      1) 1/2 inch (12.5 mm): 100.
      2) 3/8 inch (9.5 mm): 85 to 100.
      3) No. 4 (4.75 mm) 10 to 30.
      4) No. 8 (2.36 mm): 0 to 10.
      5) No. 16 (1.18 mm): 0 to 5.

3. Type PennDOT 2A Aggregate: Comply with PennDOT Publication 408, Section 703.2, Table C:

   a. Percent Passing According to Sieve Size:

      1) 2 inches (50 mm): 100.
      2) 3/4 inch (19 mm): 52 to 100.
      3) 3/8 inch (9.5 mm): 36 to 70.
      4) No. 4 (4.75 mm) 24 to 50.
      5) No. 16 (1.18 mm): 10 to 30.

6) No. 200 (75 micro m): 10 max.

2.3 SOURCE QUALITY CONTROL

A. Testing and Analysis of Aggregate Materials:

1. Coarse Aggregate Materials: Comply with ASTM D422 and ASTM D4318.
2. If tests indicate materials do not meet specified requirements, change material and retest.

B. Certificate of Compliance:

1. If supplier is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at source conforms to Contract Documents.
2. Specified source tests are not required for Work performed by approved supplier.

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Owner's Geotechnical Consultant present for compliance with requirements for maximum moisture content, installation tolerances, compaction, and other conditions affecting performance of the Work.

3.2 EXCAVATION AND STOCKPILING OF AGGREGATE MATERIALS

A. Remove excess excavated materials not intended for reuse from Site at no additional cost to the Owner.
B. Remove excavated materials not meeting requirements for coarse aggregate materials from Site at no additional cost to the Owner.
C. Stockpile materials on Site at locations indicated.

1. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
2. Direct surface water away from stockpile site to prevent erosion or deterioration of aggregate materials.

3.3 CLEANING

A. Remove stockpile and leave area in clean and neat condition.
B. Grade Site surface to prevent freestanding surface water.
C. Fine grade, topsoil and re-seed stockpile area as applicable

END OF SECTION 32 05 16

SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Document Report of Geotechnical Exploration for Jarrettown Elementary School dated January 19, 2026, prepared by David Blackmore and Associates, Inc. for geotechnical report, borehole locations, and findings of subsurface materials.
2. Section 310516 "Aggregates for Earthwork."
3. Section 310519.13 "Geotextiles for Earthwork" for woven geotextile used for erosion control.
4. Section 312213 "Rough Grading" for preparation of Site for base course.
5. Section 312316.13 "Trenching" for compacted fill under base course.
6. Section 312323 "Fill" for compacted fill under base course.
7. Section 313716.13 "Rubble-Stone Riprap."
8. Section 320516 "Aggregates for Exterior Improvements."
9. Section 321216 "Asphalt Paving" for binder and finish asphalt courses.
10. Section 321313 "Concrete Paving" for finish concrete surface course.
11. Section 321413 "Precast Concrete Unit Paving."
12. Section 321713 "Parking Bumpers" for concrete bumpers.
13. Section 329119 "Landscape Grading" for topsoil fill at areas adjacent to aggregate base course.
14. Section 330561 "Concrete Manholes" for manholes including frames.
15. Section 312000 "Earth Moving" for subbase preparation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1.3 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For subbase and base course aggregate materials.

1.4 QUALITY ASSURANCE

A. Furnish each subbase and base course aggregate material from single source throughout Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work in accordance with:

1. The State of Pennsylvania Department of Transportation standards.

2.2 AGGREGATE MATERIALS

A. Subbase Aggregate: PennDOT 2A Aggregate; graded type.

1. Percent Passing per Sieve Size:

a. 2 Inches (50 mm): 100.
b. 3/4 inch (19 mm): 52 to 100.
c. 3/8 inch (9.5 mm): 36 to 70.
d. No. 4 (4.75 mm): 24 to 50.
e. No. 16 (1.18 mm): 10 to 30.
f. No. 200 (75 micro m): 10 max.

B. Coarse Aggregate: Fill Type AASHTO #57 or PennDOT 2A as specified in Section 320516 "Aggregates for Exterior Improvements".

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Owner's Geotechnical Consultant present, for compliance with requirements for maximum moisture content, installation tolerances, compaction and other conditions affecting performance of the Work.
B. Verify that underlying surface is smooth and free of ruts or protrusions that could damage geotextile fabric.
C. Verify compacted substrate is dry and ready to support paving and imposed loads.

1. Proof roll substrate with smooth drum roller (minimum 15 ton) in minimum two perpendicular passes to identify soft spots.
2. Remove soft substrate and replace with compacted fill as specified in Section 312323 "Fill."

D. Verify substrate has been inspected, and gradients and elevations are correct.
E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 INSTALLATION OF AGGREGATE MATERIALS

A. Spread aggregate over prepared substrate to total compacted thickness as indicated on Drawings.
B. Roller compact aggregate to density scheduled in this Section.
C. Level and contour surfaces to elevations, profiles, and gradients indicated.
D. Maintain optimum moisture content of fill materials to attain specified compaction density.
E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch measured with 10-foot straight edge.
B. Maximum Variation from Thickness: 1/4 inch.
C. Maximum Variation from Elevation: 1/2 inch.

3.5 FIELD QUALITY CONTROL

A. Compaction testing to be performed in accordance with ASTM D6938.
B. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
C. Frequency of Tests: One test for every 2,000 sq. ft. of each layer of compacted aggregate.

3.6 COMPACTION

A. Compact materials to 98 percent maximum density as determined from field tests, in accordance with ASTM D2940/D2940M.

END OF SECTION 32 11 23

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SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of This Section Includes:

1. Cold milling of existing asphalt pavement.
2. New asphalt paving as indicated on the Drawings.
3. Asphalt traffic-calming devices.

B. Related Requirements:

1. Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition" for demolition and removal of existing asphalt pavement.
2. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
3. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture warm mix asphalt.
b. Review condition of substrate and preparatory work performed by other trades
c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
d. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving installer’s personnel, and equipment required to execute the work without delays.
e. Review inspection and testing requirements, governing regulations, and proposed installation procedures
f. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Include technical data and tested physical and performance properties.

B. Job-Mix Design: Certification, by PennDOT and other authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

D. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:

1. Paving Geotextile: 12 by 12 inches minimum.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. Aggregates.
2. Asphalt binder.
3. Tack coat.

B. Field Quality Control Reports: For specified tests and inspections.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage a firm experienced in manufacturing warm mix asphalt similar to that indicated for this project and with a record of successful in-service performance..

1. Firm shall be registered and approved paving mix manufacturer listed in PennDOT Bulletin No. 15.

B. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Publication 408, latest edition as amended of Pennsylvania Department of Transportation (PennDOT) standard specifications for asphalt paving work.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate

cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 40 deg F and rising at time of placement .
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Binder Course: Minimum surface temperature of 40 deg F and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 40 deg F and rising at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

1. Provide aggregate from sources listed in PennDOT Bulletin 14. Aggregate shall conform to the quality requirements for Superpave Asphalt Mixture Design as specified in PennDOT Bulletin 27. For wearing courses, provide aggregate with at least the SRL designation specified.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
C. Fine Aggregate: ASTM D1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
D. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 binder designation PG 64-22.
B. Asphalt Cement: ASTM D3381/D3381M for viscosity-graded material.
C. Tack Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
D. Water: Potable.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.
B. Sand: ASTM D1073, Grade No. 2 or No. 3.
C. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to

chemical attack, rot, and mildew; and specifically designed for paving applications.

2.4 MIXES

A. Warm Mix Asphalt: Provide warm mix asphalt plant mixes approved by PennDOT. Provide warm mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the PennDOT Publication 408 standard specifications.

1. Standard Specification: As indicated and in accordance with PennDOT Form 408 requirements. When there is a discrepancy between the project specifications and PennDOT Form 408, Form 408 requirements shall govern for pavement materials and installation. Except no slag or recycled materials (other than RAP) shall be allowed. Contractor is solely responsible for locating a waste disposal area and shall dispose of all waste materials in accordance with state, local, and federal regulations. The maximum permitted RAP for paving materials is 15%.
2. Warm-Mix Asphalt: Provide warm-mix asphalt plant mixes approved by PennDOT.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.
B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.
B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a smooth drum roller weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING OF EXISTING ASPHALT PAVEMENT

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross

sections indicated.

1. The milling of the existing Asphalt Pavement Surface shall be done in accordance with Section 491, “Milling of Bituminous Pavement Surface” Pennsylvania Department of Transportation Specification 408, latest edition, and in accordance with the details and instructions on the construction Drawings, Contract Plans and contained in these specifications.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling. The cost to perform repairs or replacement shall be incidental to the cost of 'Milling'.
5. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
6. The removal and disposal of the existing pavement shall be included in the pay item for 'Milling'.
7. Keep milled pavement surface free of loose material and dust.
8. Do not allow milled materials to accumulate on-site.

3.4 WARM-MIX ASPHALT PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.02 tp 0.07 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying warm-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 SURFACE PREPARATION FOR WARM-MIX ASPHALT

A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Herbicide Treatment: Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.02 to 0.07 gal./sq/ yd.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 PLACEMENT OF WARM-MIX ASPHALT

A. Machine place warm-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place warm-mix asphalt base course and binder course in number of lifts and thicknesses indicated
2. Place warm-mix asphalt surface course in a single lift.
3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeedign strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1'2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course and binder course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface

3.7 INSTALLATION OF JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as warmmix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION OF WARM-MIX ASPHALT

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

   1. Complete compaction before mix temperature cools to 160 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

   1. Average Density, Rice Test Method: 95 percent of reference maximum theoretical density in accordance with Pennsylvania Test Methon PTM No. 715, but not less than 91 percent or greater than 98 percent. (Per PennDOT 408, Section 413)

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while warm mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; with suitable hand tools. Do not use rakes. Compact thoroughly using tamper or other satisfactory method. Where the existing cartway is not curbed, if the difference in elevations between the finished grade of pavement and the existing grade of adjacent surface is 2-inches or more, provide a Safety Edge per FHWA Every Day Counts Accelerating Technology Safety Edge Specifications. See also the Safety Edge detail on the construction drawings. Installation of safety edge is incidental to paving. No additional payment is provided for Safety Edge installation

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

   1. Base Course: Plus or minus 1/4 inch.
   2. Binder Course: Plus or minus 1/4 inch.
   3. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Binder Course: 1/4 inch.
3. Surface Course: 1/8 inch.
4. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Asphalt Traffic-Calming Devices: Compact and form asphalt to the shapes indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Thickness: In-place compacted thickness of warm-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.
C. Surface Smoothness: Finished surface of each warm-mix asphalt course will be tested for compliance with smoothness tolerances.
D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.
E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with Pennsylvania Test Methods, PTM No. 1 and PTM No. 729 .
F. Replace and compact warm-mix asphalt where core tests were taken.
G. Remove and replace or install additional warm-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 WASTE HANDLING

A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

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SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete paving for curbs and gutters walks and includes the following:

1. Forms.
2. Steel reinforcement.
3. Concrete materials.
4. Fiber reinforcement.
5. Curing materials.
6. Special finish materials.

B. Products Installed, but Not Furnished, under This Section:

1. Detectable warning tiles.

C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 321316 "Decorative Concrete Paving" for stamped concrete other than stamped detectable warnings.
3. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
4. Section 321713 "Parking Bumpers."
5. Section 321723 "Pavement Markings."
6. Section 321726 "Tactile Warning Surfacing" for detectable warning paving units and tiles.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not

limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

a. Contractor's superintendent.
b. Concrete paving Subcontractor.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of specified product.
B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Special finish materials.
7. Joint fillers.
8. Bonding agent.
9. Epoxy-bonding adhesive.

B. Material Test Reports: For aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
C. Field Quality Control Reports: For specified tests and inspections.

1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests must be qualified as ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CP-1 or an equivalent certification program.

1.7 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to 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 in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.
B. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.
C. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
D. Epoxy-Coated, Joint Dowel Bars: ASTM A775/A775M; with ASTM A615/A615M, Grade 60 plain-steel bars.
E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports in accordance with CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

    1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
    2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

F. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.
G. Zinc Repair Material: ASTM A780/A780M.

2.4 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

    1. Portland Cement: ASTM C150/C150M, white portland cement Type I Type I/II Type III.
    2. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, portland blast-furnace slag Type IP, portland-pozzolan Type IL, Portland-limestone cement.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 4M, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

    1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
    2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.
D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material. Do not use admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E
5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
6. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

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) Catexol 1000CL; Axim Concrete Technologies.
2) MCI 2005; Coretec Corporation.
3) DCI or DCI-S: GCP Applied Technologies
4) MasterLife CI 222: BASF/Master Builders Solutions
5) Sika Ferrogard S; Sika Corporation

E. Water: Potable and complying with ASTM C94/C94M.

2.5 CURING MATERIALS

A. Water: Potable.
B. Curing Compounds:

1. White, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 2, Class A, dissipating.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Aquron; CPT-2000 or comparable product by one of the following:

1) Aquron Corporation
2) Concrete Sealers USA
3) Solomon Colors, Inc.

2.6 ACCESSORY MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber in preformed strips.
B. 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, of grade complying with requirements, and of the following types:

1. Types I and II, nonload bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned in accordance with ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly As 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. 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.
6. 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.

C. Air-Entraining Admixture: Add admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content, 3/4-inch Nominal Maximum Aggregate Size: 6 percent plus or minus 1-1/2 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

E. Chemical Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing admixture or high-range, water-reducing admixture (superplasticizer) in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): PennDOT Class A.

a. Sidewalks and Walkways: 3300 psi (PennDOT Class SW)
b. Concrete Stairs: 3500 psi.
c. Concrete Pads (Loading Areas and Trash Enclosure): 4500 psi

2. Maximum W/C Ratio at Point of Placement: .

a. Sidewalks and Walkways: 0.40
b. Concrete Pads (Loading Areas and Trash Enclosure): 0.45

3. Slump Limit: three (3) to six (6) inches.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
B. Proof-roll prepared subbase surface below concrete pads to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch in accordance with requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 INSTALLATION OF FORMS

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 INSTALLATION OF STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating in accordance with ASTM D3963/D3963M.
G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 PLACEMENT OF CONCRETE

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
F. Consolidate concrete in accordance with ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

    1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation.

Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

G. Screed paving surface with a straightedge and strike off.
H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
I. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.
B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

a. 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.

3.7 INSTALLATION OF DETECTABLE WARNING PAVING UNITS

A. Form blockouts in concrete for installation of detectable warning paving units specified in Section 321726 "Tactile Warning Surfacing."

1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

3.8 INSTALLATION OF DETECTABLE WARNING TILES

A. Form blockouts in concrete for installation of cast-in-place detectable warning tiles specified in Section 321726 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with Section 321726 "Tactile Warning Surfacing" immediately after screeding concrete surface.

3.9 CURING OF CONCRETE

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.
C. Curing Methods: Cure concrete by curing compound a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.

2. Curing Compounds: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained in accordance with ASTM C172/C172M will be performed in accordance with the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., please one set for each additional 50 cu. yd. or fraction thereof of each concrete mixture placed each day.

a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing 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; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test to be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
D. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
E. Test results to be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests to contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
F. Additional Tests: Testing and inspecting agency will 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.
G. Concrete paving will be considered defective if it does not pass tests and inspections.
H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
I. Prepare test and inspection reports.

3.12 PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days

after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joint-sealant backer materials.
2. Primers.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Concrete pavement joint sealants.
2. Joint-sealant backer materials.

1.3 FIELD CONDITIONS

A. 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.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backer materials, 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.

2.3 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.
B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints 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. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

    1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on 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.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.
C. Install joint-sealant backers to support joint 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 joint-sealant backer materials.
2. Do not stretch, twist, puncture, or tear joint-sealant backer materials.
3. Remove absorbent joint-sealant backer materials that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backer material installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants in accordance with the following requirements 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 joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
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 and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joints within Concrete Paving:

1. Joint Location:

    a. Expansion and isolation joints in concrete paving.
    b. Contraction joints in concrete paving.
    c. Other joints as indicated.

2. Joint Sealant: Single-component, nonsag, silicone joint sealant.
3. Joint-Sealant Color: Manufacturer's standard.

B. Joints within Concrete Paving and Between Concrete and Asphalt Paving:

1. Joint Location:

    a. Joints between concrete and asphalt paving.
    b. Joints between concrete curbs and asphalt paving.
    c. Other joints as indicated.

2. Joint Sealant: PG64-22.
3. Joint-Sealant Color: Manufacturer's standard.

END OF SECTION 32 13 73

SECTION 32 16 23 - SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aggregate subgrade.
B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form materials, waterstops, and accessories.
2. Section 032000 "Concrete Reinforcing" for reinforcing steel and supports for cast-in-place concrete.
3. Section 033000.01 "Cast-in-Place Concrete for Infrastructure" for cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components.
4. Section 312213 "Rough Grading" for preparation of Site for paving and base grade.
5. Section 312323 "Fill" for compacted subgrade for paving.
6. Section 321123 "Aggregate Base Courses" for stone base course.
7. Section 329119 "Landscape Grading" for preparation of subsoil at pavement perimeter.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Aggregate subgrade.

B. Submit required information regarding concrete materials , joint filler, admixtures, and curing compounds.
C. Mix Design:

1. Submit concrete mix design for each concrete strength prior to commencement of Work.
2. Submit separate mix designs if admixtures are required for hot- and cold-weather concrete Work.
3. Identify mix ingredients and proportions, including admixtures.

D. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

1.3 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For aggregate subgrade.

B. Field Quality-Control Reports: For aggregate subgrade.
C. Qualifications Statements: For installer.

1.4 QUALITY ASSURANCE

A. Perform Work according to Sections 031000 "Concrete Forming and Accessories", 032000 "Concrete Reinforcing", and 033000.01 "Cast-in-Place Concrete for Infrastructure".
B. Obtain cementitious materials from same source throughout.
C. Installer Qualifications: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
B. Store materials according to manufacturer instructions.
C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.6 FIELD CONDITIONS

A. Minimum Conditions: Do not place concrete if base surface temperature is less than 40 degrees F, or if surface is wet or frozen.
B. Subsequent Conditions: Maintain minimum 50 degrees F, for not less than 72 hours after placing, and at a temperature above freezing for remainder of curing period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

2.2 AGGREGATE SUBGRADE

A. As specified in Section 321123 "Aggregate Base Courses".

2.3 MATERIALS

A. Forms:

1. Height: Equal to full depth of finished sidewalk.
2. Material:

a. Wood: Straight and free from warping, twisting, loose knots, splits, or other defects.
b. Steel: Channel-formed sections.

3. Profile: To suit conditions.
4. Joint Filler:

a. Premolded compressible.
b. Thickness: 1/2 inch.
c. Comply with ASTM D1751.

B. Reinforcement:

1. Reinforcing Steel and Wire Fabric: As specified in Section 321313 "Concrete Paving".

C. Concrete:

1. Concrete Materials:

a. As specified in Section 312313 "Concrete Paving".
b. Furnish materials according to State of Pennsylvania Department of Transportation, Publication 408 standards.

2. Cement:

a. Comply with ASTM C150/C150M.
b. Type: I - Normal II - Moderate portland.
c. Color: White.

3. Blended Cement:

a. Comply with ASTM C595/C595M.
b. Type: 1L, Portland-Limestone.
c. Color: White.

4. Fine and Coarse Aggregates:

a. Comply with ASTM C33/C33M.
b. Class: 4M.
c. Coarse Aggregate Maximum Size: 3/4 inch.

5. Water:

a. Potable.
b. Comply with ASTM C94/C94M.

6. Air Entrainment: Comply with ASTM C260/C260M.
7. Chemical Admixtures:

a. Comply with ASTM C494/C494M.
b. Type A - Water Reducing.
c. Type D - Water Reducing and Retarding.
d. Type E - Water Reducing and Accelerating.
e. Type F - Water Reducing, High Range.

8. Fly Ash:

a. Comply with ASTM C618.
b. Class: F.

9. Slag:

a. Ground-granulated blast-furnace slag.
b. Comply with ASTM C989/C989M.
c. Grade: 100.

10. Color Pigment:

a. Comply with ASTM C979/C979M.
b. Resistant to mineral oxides, alkalis, and fading.
c. Color: As selected.

2.4 FABRICATION

A. Reinforcing:

1. Comply with CRSI Manual of Practice.
2. Comply with State of Pennsylvania Department of Transportation, Publication 408 standards.

2.5 MIXES

A. Concrete:

1. Pennsylvania Department of Transportation, Publication 408 Standards, Class SW Concrete.

B. Concrete Mix:

1. Mix concrete according to ACI 304 and deliver concrete according to ASTM C94/C94M.

2. Mix Design:

    a. Compressive Strength:

        1) Seven Day: 2750 psi.
        2) 28 Day: 3300 psi.

    b. Minimum Cement Content: 564 lb./cu. yd.
    c. Maximum Water/Cement Ratio: 0.5 by weight.
    d. Air Entrainment: six (6) percent.

3. Admixtures:

    a. Use of admixtures will not relax cold-weather placement requirements.
    b. Do not use calcium chloride.

2.6 ACCESSORIES

A. Curing Compound, Type 1:

1. Comply with ASTM C309.
2. Type: 2.
3. Class: A.

B. Liquid Surface Sealer: CPT-2000, as manufactured by Aquron Corporation.

C. Joint Sealers:

1. As specified in Section 312313 "Concrete Paving Joint Sealer".

D. Cover Sheets:

1. Comply with ASTM C171, Type polyethylene film or white burlap-polyethylene sheet.
2. Burlap: Comply with AASHTO M182.

2.7 SOURCE QUALITY CONTROL

A. Testing: Comply with ASTM C94/C94M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
B. Verify that gradients and elevations of subgrade are as indicated on Drawings.
C. Verify reinforcing placement for proper size, spacing, location, and support.

3.2 PREPARATION

A. Moisten substrate to minimize absorption of water from fresh concrete.
B. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 INSTALLATION OF AGGREGATE SUBGRADE

A. As specified in Section 321123 "Aggregate Base Courses".

3.4 INSTALLATION OF MATERIALS

A. Forms:

1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
3. Clean forms and coat with form oil each time before concrete is placed.
4. Wood Forms: Thoroughly wet with water before concrete is placed.

B. Reinforcement:

1. Place reinforcing as indicated on Drawings.
2. Interrupt reinforcing at contraction and expansion joints.
3. Place reinforcing to achieve indicated paving alignment.
4. Repair damaged epoxy coating to match shop finish.

C. Placing Concrete:

1. Place concrete in forms in one layer.
2. Ensure that reinforcing, inserts, embedded parts, formed joints, and are not disturbed during concrete placement.
3. Place concrete continuously over full width of panel and between predetermined construction joints.
4. Do not break or interrupt successive pours such that cold joints occur.
5. Consolidate concrete by tamping and vibration.
6. Place concrete to pattern as indicated.

D. Joints:

1. Place continuous transverse expansion joints at 30-foot intervals or width of sidewalk, whichever is less.
2. Filler:

    a. Place joint filler between paving components and building or other appurtenances.
    b. Recess top of filler 3/4 inch for sealant installation.

3. Provide scored joints at 5-foot intervals between sidewalks and curbs.
4. Seal joints as indicated on Drawings .

E. Finishing:

1. Light broom to 1/4-inch radius, and trowel edges of joints.
2. Wood float.
3. Texture Direction: Perpendicular to Path of Travel.
4. Ramps: Broom perpendicular to slope.
5. Place curing compound and sealer on exposed concrete surfaces immediately after finishing.
6. Edges and Joints:

    a. Edger Radius: 1/4 inch.
    b. Spalled Corners and Edges: Clean and fill with mortar mixture and finish.

3.5 INSTALLATION OF ACCESSORIES

A. Curing:

1. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
2. Mats:

    a. Cover exposed surface with two or more layers of wetted burlap, overlapping each other minimum 12 inches.
    b. Maintain burlap continuously saturated and in contact with concrete for minimum seven days.

3. Impervious Sheeting:

    a. Maintain sheet in contact with concrete for minimum seven days.
    b. Wet exposed surface and cover with impervious sheeting material, overlapped minimum 12 inches.

4. Membrane Curing:

    a. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

B. Backfilling: After curing, backfill, grade, and compact adjacent disturbed area as indicated.

3.6 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.

B. Maximum Variation from True Position: 1/4 inch.
C. Line and Grade for Forms: 1/8 inch in any 10-foot- long section.

3.7 FIELD QUALITY CONTROL

A. Inspection and Testing:

1. Comply with ASTM C94/C94M.
2. Comply with State of Pennsylvania standards.
3. Samples:

    a. Sampling Procedures: Comply with ASTM C172/C172M.
    b. Cylinder Molding and Curing Procedures: Comply with ASTM C31/C31M, field cured.
    c. Sample concrete and make one set of four cylinders for every 5 cu. yd. but less than 25 cu. yd, plus one set for each additional 50 cu. yd. or fraction thereof of each class of concrete placed each day .

4. Cylinder Compressive Strength:

    a. Comply with ASTM C39/C39M.
    b. Acceptance:

        1) According to Pennsylvania Department of Transportation, PTM standards.

    c. Test two cylinders at seven days, and two cylinders at 28 days.

5. Slump, Temperature, and Air Content:

    a. Measure for each compressive-strength concrete sample.
    b. Slump: Comply with ASTM C143/C143M.
    c. Air Content: Comply with ASTM C231/C231M.
    d. Temperature: Comply with ASTM C1064/C1064M.

6. Records:

    a. Maintain records of placed concrete items.
    b. Record date, location of pour, quantity, air temperature, number of test samples taken.

3.8 PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, rain and flowing water, and mechanical injury.
B. Do not permit traffic over paving for minimum three (3) days after finishing.
C. Damaged Concrete:

1. Remove and reconstruct concrete that has been damaged for entire length between scheduled joints.
2. Refinishing damaged portion is not acceptable.
3. Dispose of damaged portions.

END OF SECTION 32 16 23

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SECTION 32 17 13 - PARKING BUMPERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast concrete wheel stops.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

PART 2 - PRODUCTS

2.1 PARKING BUMPERS

A. Precast Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete; 3500-psi minimum compressive strength; 7 inches high by 7 inches wide by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of three factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.

1. Source Limitations: Obtain wheel stops from single source from single manufacturer.
2. Surface Appearance: Smooth, free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
3. Surface Sealer: Manufacturer's standard salt-resistant, clear sealer, applied at precasting location.
4. Mounting Hardware: Galvanized-steel spike or dowel, 3/4-inch diameter, 24-inch minimum length .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation in accordance with manufacturer's written instructions.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PARKING BUMPERS

A. Install wheel stops in accordance with manufacturer's written instructions unless otherwise indicated.
B. Install wheel stops in bed of adhesive before anchoring to substrate.
C. Securely anchor wheel stops to substrate with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION 32 17 13

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pavement-marking paint, latex.

B. Related Requirements:

1. Section 071800 "Traffic Coatings" for painting whole areas of building floors and pavements with coatings having an integral wearing surface.
2. Section 099113 "Exterior Painting" for painting exterior concrete surfaces other than pavement markings.
3. Section 099123 "Interior Painting" for painting interior concrete surfaces other than pavement markings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Publication 408 of Pennsylvania Department of Transportation for pavement-marking work.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain pavement-marking paints from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.3 PAVEMENT MARKINGS

A. Pavement-Marking Paint:

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. Pittsburgh Paints Company (The)
    b. Rust-Oleum Corporation
    c. Sherwin-Williams Company (The)

B. Pavement-Marking Paint, Latex: MPI #97, latex traffic-marking paint.

1. Color: As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.
B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 APPLICATION OF PAVEMENT-MARKING PAINT

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.
C. Sweep and clean surface to eliminate loose material and dust.
D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.3 PROTECTION

A. Protect pavement markings from damage and wear during remainder of construction period.

3.4 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 32 17 23

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SECTION 32 17 26 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Detectable warning tiles.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing.

1.4 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces 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 and wear.
b. Separation or delamination of materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations: Obtain each type of tactile warning surfacing, joint material, setting material, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

2.3 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles with replaceable surface configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Armor-Tile; Tactile Systems or comparable product by one of the following:

    a. ACO Polymer Products, Inc.
    b. ADA Solutions, a division of SureWerx USA
    c. Armor-Tile
    d. Armorcast Products Company; brand of Hubbell Utility Solutions; Hubbell Incorporated
    e. Detectable Warning Systems, Inc.

2. Material: Cast-fiber-reinforced polymer concrete tile.
3. Color: As selected by Architect from manufacturer's full line.
4. Shapes and Sizes:

    a. Rectangular panel, width of walking surface (48 inches minimum) by minimum of 24 inches.

5. Dome Spacing and Configuration: Manufacturer's standard compliant spacing, in manufacturer's standard pattern.
6. Mounting:

    a. Replaceable detectable warning tile wet-set into freshly poured concrete and surface-fastened to permanently embedded anchors.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish Type 304 stainless-steel fasteners for exterior use.
2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TACTILE WARNING SURFACING, GENERAL

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.
B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.3 INSTALLATION OF DETECTABLE WARNING TILES

A. Removable Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of removable tile.
2. Set each detectable warning tile accurately and firmly in place with embedding anchors and fasteners attached, and firmly seat tile back in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from

tile surfaces.

5. Clean tiles using methods recommended in writing by manufacturer.

3.4 CLEANING

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

3.5 PROTECTION

A. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 32 17 26

SECTION 32 18 16.13 - PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tile surfacing.
2. Loose-fill surfacing.
3. Geosynthetic accessories.

1.2 DEFINITIONS

A. Definitions in ASTM F2223 apply to Work of this Section.
B. Critical Height: Standard measure of shock attenuation according to ASTM F2223; same as "critical fall height" in ASTM F1292. According to ASTM F1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."
C. SBR: Styrene-butadiene rubber.
D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F2223.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of specified product.
B. Shop Drawings: For each type of protective surfacing.

1. Include plans, sections, placement and penetration details, and attachment to substrates.
2. Include accessories and edge terminations.
3. Include patterns made by varying colors of surfacing and details of graphics.
4. Include fall heights and use zones for equipment and structures specified in Section 116800 "Play Field Equipment and Structures," coordinated with the critical heights for protective surfacing.

C. Product Schedule: For protective surfacing. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of loose-fill surfacing.
B. Product Certificates: For each type of unitary surfacing product.
C. Field Quality Control Reports: For specified tests and inspections.

D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Loose Fill: Amount equal to 1 percent of amount installed, but no fewer than 3 units
2. Edging Units: 3 full-size units.

1.7 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Reduction in impact attenuation as measured by reduction of critical fall height.
b. Deterioration of protective surfacing and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations: Obtain protective surfacing materials, including loose-fill accessories, from single source from single manufacturer.

1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

2.2 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: Critical fall height tested according to ASTM F1292.

B. Accessibility Standard: Minimum surfacing performance according to ASTM F1951.

2.3 LOOSE-FILL SURFACING

A. Inorganic Loose-Fill Surfacing:

1. Shredded Rubber : Rubber particles, free from steel wires, rubber dust, and other foreign substances, tested for impact attenuation according to ASTM F1292 and for accessibility according to ASTM F1951.

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) GameTime; a PlayCore Company
2) IMC Outdoor Living. A Division of Liberty Tire Recycling
3) Little Tikes Company U.S. (The); PlayPower Inc.
4) No Fault LLC
5) Playsafe Surfacing LLC
6) Sof'Solutions Inc.

b. Critical Height: As indicated on Drawings.
c. Uncompressed Material Depth: Not less than as indicated on Drawings.
d. Color(s): As selected by Architect from manufacturer's full range.

B. Loose-Fill Surfacing Accessories:

1. Edging: Anchored-in-place, weather-resistant containment barrier designed to minimize sharp edges, protrusions, and tripping hazards; formed by interconnected, modular units.

a. Rubber Edging Units : Compression molded from SBR, in manufacturer's standard sizes.

1) Color: As selected by Architect from manufacturer's full range.

2.4 GEOSYNTHETIC ACCESSORIES

A. Drainage/Separation Geotextile : Comply with Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions

affecting performance of the Work.

1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

3.3 INSTALLATION OF GEOSYNTHETIC ACCESSORIES

A. Install geosynthetic accessories before edging and according to playground surface system manufacturer's and geosynthetic manufacturer's written instructions and in a manner that cannot become a tripping hazard.

1. Drainage/Separation Geotextile: Completely cover area beneath protective surfacing, overlapping geotextile sides and edges a minimum of 12 inches with manufacturer's standard treatment for seams.

3.4 INSTALLATION OF LOOSE-FILL SURFACING

A. Apply components of loose-fill surfacing according to manufacturer's written instructions to produce a uniform surface.
B. Edging: Place and permanently secure edging in place, and attach units to each other.
C. Loose Fill: Place loose-fill materials to required depth after installation of playground equipment support posts and foundations. Include manufacturer's recommended amount of additional material to offset natural compaction over time.
D. Grading: Uniformly grade loose fill to an even surface free from irregularities.
E. Compaction: After initial grading, mechanically compact loose fill before finish grading.
F. Finish Grading: Hand rake to a uniformly smooth finished surface and to required elevations.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests.
B. Tests and Inspections: Perform the following tests:

1. Perform "Installed Surface Performance Test" according to ASTM F1292 for each protective surfacing type and thickness in each playground area.
2. Perform installed-surface-performance tests at no less than one series of tests for each 1000 sq. ft. of each type and thickness of in-place protective surfacing or part thereof.
3. Playground protective surfacing will be considered defective if it does not pass

tests.

4. Prepare test reports.

END OF SECTION 32 18 16.13

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SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 -GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain-link fence framework.
2. Chain-link fence fabric.
3. Chain-link fittings.
4. Chain-link wires and ties.
5. Chain-link swing gates.
6. Chain-link horizontal-slide gates.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
b. Fence and gate posts, rails, and fittings.
c. Chain-link fabric, reinforcements, and attachments.
d. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, ground details, mounting, post spacing, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

C. Delegated Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of chain-link fence, and gate.
B. Product Test Reports: For framework strength in accordance with ASTM F1043, for tests performed by manufacturer and witnessed by a qualified testing

agency.

C. Field quality-control reports.
D. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fences, gates, operators, and controls that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to comply with performance requirements.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

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, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate frameworks.
B. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.
C. Accessibility: Pedestrian gates to comply with the United States Access Board's ADA-ABA Accessibility Guidelines.

2.2 CHAIN-LINK FENCES, GENERAL

A. CLFMI Publications: Comply with the CLFMI Product Manual unless modified by requirements in the Contract Documents.
B. Chain-Link Fence and Gate Assemblies: Include materials applicable for a complete assembly of application types, consisting of commercial, industrial, and security chain-link fences and gates.

    1. Source Limitations: Obtain chain-link fence and gate components from single source or manufacturer.

C. Reference FENCE - CHAIN LINK and CHAIN LINK FENCE DETAILS as indicated on the Drawings.

2.3 CONCRETE

A. Concrete Post Footings: Minimum 28-day compressive strength of 3000 psi (PennDOT Class A).

2.4 GROUNDING MATERIALS

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

PART 3 -EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

    1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 200 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and

property monuments.

3.3 INSTALLATION OF CHAIN-LINK FENCES

A. Install chain-link fencing in accordance with ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.

D. Terminal Posts: Install terminal end, corner, and gate posts in accordance with ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 10 feet o.c.

F. Post Bracing and Intermediate Rails: Install in accordance with ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

G. Tension Wire: Install in accordance with ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 4 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

H. Top Rail: Install in accordance with ASTM F567, maintaining plumb position

and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 12 inches o.c.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric in accordance with ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

    1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 18 inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 INSTALLATION OF GATES

A. Install gates in accordance with manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GROUNDING AND BONDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fence and Gate Grounding:

    1. Ground for fence and fence posts is to be a separate system from ground for gate and gate posts.
    2. Ground fence on each side of gates and other fence openings.

        a. Bond metal gates to gate posts.
        b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire

and bury it at least 18 inches below finished grade.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground in accordance with IEEE C2 unless otherwise indicated.
D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

E. Connections:

1. Make connections with clean, bare metal at points of contact.
2. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
4. Make above-grade ground connections with mechanical fasteners.
5. Make below-grade ground connections with exothermic welds.
6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. Comply with requirements in Section 264113 "Lightning Protection for Structures."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.
B. Grounding Tests: Comply with requirements in Section 264113 "Lightning Protection for Structures."
C. Prepare test reports.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
B. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 32 31 13

SECTION 32 31 19 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Decorative steel fences.
2. Swing gates.

B. Related Requirements:

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, gate locations, post spacing, and mounting attachment details, and grounding details.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gate operators to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 DECORATIVE STEEL FENCES

A. Decorative Steel Fence Assembly: Fences made from steel tubing bars and shapes, hot-dip galvanized.
B. Basis-of-Design Product: Subject to compliance with requirements, provide Iron World; Maverick Supreme Plus Aberdene or comparable product by one of the following:

1. A&T Iron Works, Inc
2. Ametco Manufacturing Corporation

3. Iron World

C. Posts: Square steel tubing.

1. Line Posts: 3 by 3 inches with 12 GA wall thickness.
2. End and Corner Posts: 3 by 3 inches with 12 GA wall thickness.
3. Swing Gate Posts: 3 by 3 inches with 12 GA wall thickness.

D. Post Caps: Formed from steel sheet and hot-dip galvanized after forming.
E. Rails:

1. Steel Channel Rails: Steel channels 1-3/8 by 1-1/2 inch.

F. Pickets: 1 inch square by 0.065-inch steel tubes.

1. Picket Placement: Terminate tops of pickets at top rail for flush top appearance.
2. Picket Spacing: As indicated on the Drawings clear, maximum.

G. Fasteners: Stainless steel carriage bolts and tamperproof nuts.
H. Fabrication:

1. Assemble fences into sections by welding pickets to rails.

a. Fabricate sections with clips welded to rails for field fastening to posts.
b. Drill posts and clips for fasteners before finishing to maximum extent possible.

I. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
J. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

1. Hot-dip galvanize posts and rails.
2. Hot-dip galvanize rail and picket assemblies after fabrication.
3. Hot-dip galvanize bar grating infill after fabrication.
4. Hot-dip galvanize custom-design rail and infill assemblies after fabrication.

K. Finish for Bar Grating Infill: Powder coating.

2.2 SWING GATES

A. Gate Configuration: As indicated on Drawings.
B. Gate Frame Height: As indicated on Drawings.
C. Gate Opening Width: As indicated on Drawings.
D. Gate Type: As indicated on Drawings.
E. Additional Rails: Provide as indicated, complying with requirements for fence rails.
F. Gate Infill: As indicated on Drawings.
G. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers

for each gate leaf more than 5 ft. wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

H. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.

1. Function: 320 - Gate spring pivot hinge. Adjustable tension.
2. Material: Malleable iron; galvanized.

I. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.

1. Function: 39 - Full surface, triple weight, antifriction bearing.
2. Material: Wrought steel, forged steel, cast steel, or malleable iron; galvanized.

J. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

K. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 200 ft. or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 INSTALLATION OF DECORATIVE FENCES

A. Install fences in accordance with manufacturer's written instructions.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Space posts uniformly at 8 ft. o.c.

3.4 INSTALLATION OF GATES

A. Install gates in accordance with manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
B. Lubricate hardware, gate operators, and other moving parts.

3.6 DEMONSTRATION

A. Train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 32 31 19

SECTION 32 31 29 - WOOD FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood fences and gates.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD FENCES AND GATES

A. Wood Fences and Gates: Comply with ASTM F537.

1. Wood Posts:

a. Material: Pine.
b. Size: Square. 3 by 6 inches nominal.
c. Height: As indicated on Drawings.
d. Length: As indicated on Drawings.
e. Finish: Wood-preservative treated.

2. Top Rails:

a. Material: Pine.
b. Size: As indicated on Drawings.
c. Finish: Wood-preservative treated.

3. Middle Wood Rails:

a. Material: Pine.
b. Size: As indicated on Drawings.
c. Finish: Wood-preservative treated.

4. Bottom Wood Rails:

a. Material: Pine.

b. Size: As indicated on Drawings.
c. Finish: Wood-preservative treated.

5. Wood Gates: Comply with ASTM F537.

a. Materials: Pine.
b. Gate Type: Single leaf and/or Double leaf for pedestrian and vehicle assembly. As indicated on Drawings.
c. Frame Height: As indicated on Drawings.
d. Opening Width: As indicated on Drawings.
e. Finish: Wood-preservative treated.

2.2 ACCESSORIES

A. Fasteners for Wood Components: Hot-dip galvanized steel; 1-5/8 inches long. Provide finish nails where applicable.
B. Fasteners for Metal Components: Manufacturer's standard concealed and corrosion-resistant fastening system.

1. Tamper-resistant fasteners with resilient polymer washers.
2. Color-coated fasteners matching fence components.

C. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Pennsylvania Department of Transportation, Publication 408 - Class A Concrete.
D. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended in writing by manufacturer for exterior applications.
E. Brackets: Manufacturer's standard supports for top and bottom rails.
F. Gate Hardware:

1. Latch Types: Hasp and Locking Hackle.

a. Material: Hot-dip galvanized steel.

2. Lock Sets: Keyed locks.
3. Hinge Types: BHMA A156.17, Grade 1, suitable for exterior use.

a. Bolt Hook, Heavy Duty, Galvanized.

4. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch-diameter round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide hot-dip galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.

a. Finish exposed welds to comply with NOMMA Guideline 1, Finish #4 - good-quality, uniform undressed weld with minimal splatter.

5. Anti-Sag Kits: Turnbuckle system with necessary components for complete

assembly.

a. Material: Hot-dip galvanized steel.

2.3 WOOD LUMBER, GENERAL

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

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.
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 wood products.
4. Dress lumber, S4S, unless otherwise indicated.

B. Dimension Lumber Grade: No. 2.

2.4 WOOD-PRESERVATIVE-TREATED LUMBER

A. Wood-Preservative-Treated Lumber by Pressure Process: AWPA U1, use categories as follows:

1. UC4A Ground Contact: Non-critical wood products in contact with ground and exposed to all weather cycles; normal exposure conditions.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Application: Treat all wood components.

2.5 STEEL MATERIALS

A. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 50, with G90 coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 200 ft. or line of sight between stakes. Indicate locations of utilities, lawn sprinkler systems, underground structures, benchmarks, and property monuments.

    1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 INSTALLATION OF WOOD FENCES AND GATES

A. Install fences in accordance with manufacturer's written instructions and with ASTM F537.
B. Install fences by setting posts as indicated on Drawings and fastening rails to posts. Peen threads of bolts after assembly to prevent removal.
C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 30 inches plus 3 inches for each 1 ft. or fraction of 1 ft. that fence height exceeds 4 ft..
D. Post Setting: Set posts in concrete or by mechanically driving into soil at indicated spacing into firm, undisturbed soil.

    1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
    2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

        a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.

    3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
    4. Mechanically Driven Posts: Drive into soil to depth of 30 inches. Protect post top to prevent distortion.
    5. Space posts uniformly at 10 ft. o.c.

E. Wood Gates: Install gates in accordance with manufacturer's written instructions for wood fence construction, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.4 ADJUSTING

A. Wood Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
B. Lubricate hardware, gate operators, and other moving parts.

END OF SECTION 32 31 29

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SECTION 32 33 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bollards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of specified product.
B. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 BOLLARDS

A. Bollard :

1. Basis-of-Design Product: Subject to compliance with requirements, provide Encore Commercial Products, Inc (DBA Post Guard); 6" x 36" Removable Bollard - Powder Coated Yellow or comparable product by one of the following:

a. Neenah Foundry Company
b. Reliance Foundry Co. Ltd
c. Tournesol Siteworks LLC
d. Victor Stanley, Inc

2. Bollard Construction:

a. Metal: Cast iron, as indicated on drawings.

1) Outside Diameter (OD): Not less than 6 inches.

b. Style: As indicated on Drawings.
c. Overall Height: As indicated on Drawings.
d. Overall Width: .
e. Overall Depth: As indicated on Drawings.
f. Installation Method: Cast in concrete or As indicated.

3. Cast-Iron Finish: Color coated.

a. Color: Yellow.

2.2 GENERAL FINISH REQUIREMENTS

A. 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.

2.3 IRON FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SITE FURNISHINGS

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
C. Install site furnishings level, plumb, true, and positioned at locations indicated on Drawings.

END OF SECTION 32 33 00

SECTION 32 91 13 - SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work of This Section Includes:

1. Planting soils specified by composition of the mixes.

B. Related Requirements:

1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
2. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.
3. Section 329219 "Seeding" for placing planting soil in seeded areas.
4. Section 329300 "Plants" for placing planting soil for plantings.

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
B. CEC: Cation exchange capacity.
C. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
D. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
E. Imported Soil: Soil that is transported to Project site for use.
F. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
G. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
H. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
I. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
J. SSSA: Soil Science Society of America.
K. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
L. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
M. Surface Soil: Soil that is present at the top layer of the existing soil profile. In

undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

N. USCC: U.S. Composting Council.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. Include recommendations for application and use.
2. Include test data substantiating that products comply with requirements.
3. Include sieve analyses for aggregate materials.
4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:

    a. Manufacturer's qualified testing agency's certified analysis of standard products.
    b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
    c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

1.4 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.
B. Sample Collection and Labeling: Have samples taken and labeled by soil scientist (CPSS) certified by SSSA under the direction of the testing agency.

1. Number and Location of Samples: Minimum of eight representative soil samples where directed by the Landscape Architect for each soil to be used or amended for landscaping purposes.
2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.5 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.
B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1 - Physical and Mineralogical Methods":

a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1 - Physical and Mineralogical Methods."
3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1 - Physical and Mineralogical Methods."
4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1 - Physical and Mineralogical Methods"; at 85 percent compaction according to ASTM D698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3 - Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1 - Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NEC-67, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3 - Chemical Methods."
F. Recommendations: Based on the test results, state recommendations for soil

treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS SPECIFIED BY COMPOSITION

A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.
B. Existing Planting-Soil Type : Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Blend existing, on-site surface soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

1. Ratio of Loose Compost to Soil: 1:3 by volume.
2. Ratio of Loose Sphagnum Peat to Soil: 1:3 by volume.
3. Chemical Amendments to Existing Soil

    a. Rate of Lime, Sulfur, Agricultural Gypsum, Superphosphate, and Fertilizer to be determined upon consultation with Landscape Architect after completion of laboratory testing of existing soils.

2.2 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of percent available phosphoric acid as recommend in soils reports from a qualified testing agency.
B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

    1. Composition:

        a. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

    1. Composition:

        a. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

PART 3 - **EXECUTION**

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.
B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Excavation: Excavate soil from designated area(s) to full depth as necessary and stockpile until amended.
B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
C. Mixing: Spread unamended soil to a minimum depth of 4 inches, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
D. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PROTECTION

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."
B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

    1. Storage of construction materials, debris, or excavated material.
    2. Parking vehicles or equipment.
    3. Vehicle traffic.
    4. Foot traffic.
    5. Erection of sheds or structures.
    6. Impoundment of water.
    7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Landscape Architect and replace contaminated planting soil with new planting soil.

3.5 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

END OF SECTION 32 91 13

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SECTION 32 91 19 - LANDSCAPE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Topsoil material.

B. Related Requirements:

1. Section 312213 "Rough Grading" for Site contouring.
2. Section 312316.13 "Trenching" for backfilling trenches.
3. Section 312323 "Fill" for backfilling at building areas.
4. Section 320513 "Soils for Exterior Improvements."
5. Section 329219 "Seeding" for finish ground cover.
6. Section 329300 "Plants" for topsoil fill for trees, plants, and ground cover.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work in accordance with:

1. The State of Pennsylvania Department of Transportation standards.

2.2 TOPSOIL MATERIAL

A. Topsoil Material: Type stockpiled on-site topsoil and/or imported base loam as specified in Section 310513 "Soils for Earthwork".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, installation tolerances, compaction and other conditions affecting performance of the Work.
B. Verify building and trench backfilling have been inspected and approved by Owner's Geotechnical Consultant.
C. Verify substrate base has been contoured and compacted.
D. Proceed with application or installation only after unsatisfactory conditions have been

corrected.

3.2 PREPARATION

A. Protect landscaping and other features remaining as final Work.
B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.
C. Preparation for Substrate:

1. Eliminate uneven areas and low spots.
2. Remove debris, roots, branches, and stones in excess of 2 inches in size. Remove contaminated subsoil.
3. Scarify surface to depth of 6 inches where topsoil material is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil material has compacted subsoil.

3.3 APPLICATION OF TOPSOIL MATERIAL

A. Place topsoil material in areas where seeding, planting, and as directed by the Landscape Architect is required to thickness as scheduled.
B. Place topsoil material during dry weather.
C. Fine grade topsoil material to eliminate rough or low areas. Maintain profiles and contour of subgrade.
D. Remove roots, weeds, rocks, and foreign material while spreading.
E. Manually spread topsoil material close to plant material, building, and walkways to prevent damage.
F. Roll placed topsoil material.

3.4 TOLERANCES

A. Surface of Topsoil Material: Plus or minus 1/2 inch.

3.5 PROTECTION

A. Prohibit construction traffic over topsoil material.

3.6 TOPSOIL MATERIAL SCHEDULE

A. Compacted Topsoil Thicknesses:

1. Seeded Grass: 6 inches.
2. Sod: 4 inches.
3. Shrub Beds: 18 inches.
4. Flower Beds: 12 inches.

END OF SECTION 32 91 19

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SECTION 32 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Turfgrass seed.
2. Fertilizers.
3. Mulches.
4. Pesticides.
5. Erosion-control materials.

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.2 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.
B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" and drawing designations for planting soils.
E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.3 INFORMATIONAL SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

B. Product Certificates: For fertilizers, from manufacturer.

C. Product Label and Application Instructions: For pesticides and herbicides. Provide application instructions specific to Project.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
2. Pesticide Applicator: State licensed, commercial.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.7 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Spring Planting: April 1 to June 1.
2. Fall Planting: August 15 to October 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 TURFGRASS SEED

A. Turfgrass Seed : Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

1. Seed Species:

a. Quality, State Certified: State-certified seed of grass species as listed below for solar exposure.
b. Quality, Non-State Certified: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
c. Full Sun, Warm-Season Grass: Bermudagrass (Cynodon dactylon).
d. Full Sun, Cool-Season Grass: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
e. Sun and Partial Shade, Cool-Season Grass: Proportioned by weight as follows:

1) 50 percent Kentucky bluegrass (Poa pratensis).
2) 30 percent chewings red fescue (Festuca rubra variety).
3) 10 percent perennial ryegrass (Lolium perenne).
4) 10 percent redtop (Agrostis alba).

f. Shade, Cool-Season Grass: Proportioned by weight as follows:

1) 50 percent chewings red fescue (Festuca rubra variety).
2) 35 percent rough bluegrass (Poa trivialis).
3) 15 percent redtop (Agrostis alba).

2.2 FERTILIZERS

A. Commercial Fertilizer : Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition:

a. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

B. Slow-Release Fertilizer : Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition:

a. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.3 MULCHES

A. Straw Mulch : Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
B. Fiber Mulch : Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

2.4 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
B. Pre-Emergent Herbicide (Selective and Nonselective) : Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
C. Post-Emergent Herbicide (Selective and Nonselective) : Effective for controlling weed growth that has already germinated.

2.5 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets : Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 PREPARATION OF TURF AREA

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."
B. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Preparation of Turf Area" Article.
B. Erosion-Control Blankets: Install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, slow-release fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 2000-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.6 RENOVATION OF TURF

A. Renovate existing turf where indicated.
B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

    1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
    2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
E. Mow, dethatch, core aerate, and rake existing turf.
F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.
I. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

    1. Soil Amendment(s): according to requirements of Section 329113 "Soil Preparation."
    2. Initial Fertilizer: Commercial fertilizer applied according to manufacturer's recommendations.

J. Apply seed and protect with straw mulch as required for new turf.
K. Water newly planted areas and keep moist until new turf is established.

3.7 MAINTENANCE OF TURF

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

    1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
    2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
    3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow bentgrass to a height of 1/2 inch or less.
2. Mow perennial ryegrass to a height of 1 to 2 inches.
3. Mow annual ryegrass chewings red fescue to a height of 1-1/2 to 2 inches.

D. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.8 SATISFACTORY TURF

A. Turf installations will meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
3. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.9 APPLICATION OF PESTICIDES

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written instructions. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written instructions.

3.10 CLEANUP

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
C. Remove nondegradable erosion-control measures after grass establishment period.

3.11 PROTECTION

A. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

3.12 MAINTENANCE SERVICE FOR TURF

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 60 days from date of planting completion.

    a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Plugged Turf: 30 days from date of planting completion.

END OF SECTION 32 92 00

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SECTION 32 92 19 - SEEDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seed mixture.
2. Accessories.

B. Related Requirements:

1. Section 312213 "Rough Grading" for rough grading of Site.
2. Section 312316.13 "Trenching" for rough grading over cut.
3. Section 320513 "Soils for Exterior Improvements" for topsoil material.
4. Section 329113 "Soil Preparation."
5. Section 329119 "Landscape Grading" for preparation of subsoil and placement of topsoil in preparation for the Work of this Section.
6. Section 329300 "Plants."

1.2 DEFINITIONS

A. Fertilizer: A natural or artificial substance that, when added to topsoil, improves nutrient content and enhances seed germination.
B. NALP: National Association of Landscape Professionals.
C. NTEP: The National Turfgrass Evaluation Program.
D. Weeds: A vegetative species other than species specified to be established in given area. Examples include dandelion, jimsonweed, quackgrass, horsetail, morning glory, rush grass, mustard, lambsquarter, chickweed, cress, crabgrass, Canada thistle, nutgrass, poison oak, blackberry, tansy ragwort, Bermuda grass, Johnson grass, poison ivy, nimblewill, bindweed, bentgrass, wild garlic, perennial sorrel, and brome grass.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For Seed Mixture: Include type of seed and, if spraying seed mixture, type of spray machine and amount of seed, fertilizer, and limestone in pounds per 100 gallons of water.
2. For Fertilizers: Include slow and fast release and starter fertilizer types, as well as manufacturers' literature and analysis with recommended rates per soil tests and Site requirements.
3. For Accessories: Include data for mulch and lime.

4. For Herbicides: Include product label and manufacturer's application instructions specific to Project.

1.4 INFORMATIONAL SUBMITTALS

A. Qualifications Statements: For installer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Provide seed mixture in containers showing seed mix percentage, germination percentage, inert matter percentage, weed percentage, year of production, net weight, and date and location of packaging.
B. Installer Qualifications: Company specializing in performing Work of this Section with minimum five years' experience .

1. Installer's Field Supervisor: Ensure an experienced full-time supervisor is present at Project Site when Work is in progress.
2. Certifications: Provide certifications of Installer's field supervisor in one of the following categories from the NALP:

    a. Landscape Industry - Landscape Technician Certificate in Installation.
    b. Landscape Industry - Principles of Turfgrass Management Certificate.
    c. Landscape Industry - Operations Professional Certificate.

3. Herbicide Applicator: State licensed, commercial.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed Mixture: Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date and location of packaging, and compliance with state and Federal laws, as applicable. Seed delivered in damaged packaging is not acceptable.
B. Fertilizer: Deliver fertilizer in waterproof bags showing weight, chemical analysis, and manufacturer name.
C. Limestone and Herbicide: Deliver limestone and herbicide in unopened bags showing type and name of manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work in accordance with:

1. The State of Pennsylvania Department of Transportation standards.

2.2 SEED MIXTURE

A. Seed Mixture:

1. Suppliers:

a. Ernst Conservation Seeds.

2. Refer to NTEP for seed companies.

B. Grass Seed:

1. Harvested from previous year's crop and in compliance with NTEP's Location Performance Index (LPI).
2. Labeled with date of harvest, percent purity, percent germination, and noxious weed certification.
3. Provide permanent and temporary seed that has been tested within six months of date of planting.

C. Seed Species:

1. Quality Non-state Certified: Use seed species as listed below for climate exposure with not less than 85 percent germination, not less than 95 percent seed, and not more than 0.5 percent weed seed.

D. Cool Season Grasses:

1. Varieties:

a. Bentgrass (Agrostis spp.).
b. Kentucky bluegrass (Poa pratensis).
c. Red fescue grass (Festuca rubra).
d. Hairgrass (Deschampsia spp.).
e. Junegrass (Koeleria cristata).
f. Weeping alkaligrass (Puccinellia distans).
g. Redtop grass (Agrostis alba).
h. Ryegrass (Lolium).
i. Timothy grass (Phleum pratense).
j. Rough bluegrass (Poa trivialis).

2. Sun and Partial Shade, Cool-Season Grass Mix:

    a. 50 percent Kentucky bluegrass.
    b. 30 percent Chewings red fescue grass.
    c. 10 percent perennial ryegrass.
    d. 10 percent redtop grass.

3. Shade, Cool-Season Grass Mix:

    a. 50 percent Chewings red fescue grass.
    b. 35 percent rough bluegrass.
    c. 15 percent redtop grass.

2.3 ACCESSORIES

A. Mulching Material:

1. Dry oat or wheat straw that is free from weeds and foreign matter detrimental to seed life. Hay or chopped cornstalks are not acceptable.
2. Thermally processed wood fibers, chip form, free of growth- or germination-inhibiting ingredients.

B. Fertilizer:

1. Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis.
2. Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil to the following proportions:

    a. Nitrogen: 10 percent.
    b. Phosphoric Acid: 10 percent.
    c. Soluble Potash: 10 percent.

C. Lime: ASTM C602, Class O agricultural limestone containing a minimum 85 percent calcium carbonate equivalent, with 50 percent passing the 100 mesh and 95 percent passing the 20 mesh sieve.
D. Organic Compost: Refer to Section 329113 "Soil Preparation" for requirements and submittals.
E. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of grass.
F. Erosion Fabric:

1. Manufacturers:

    a. Tenax Corporation.
    b. East Coast Erosion Control
    c. US Erosion Products
    d. Western Green

2. Description:

   a. Material: Straw/coconut matting, open weave.
   b. Thickness: Product thickness of 0.28 in.
   c. Additional Items: Include steel wire staples, 6 inches long, as recommended by fabric manufacturer.

G. Herbicide: Provide pre-emergent herbicide for controlling the germination or growth of weeds within seeded areas.
H. Stakes: Softwood lumber, chisel pointed.
I. String: Inorganic fiber.

2.4 SOURCE QUALITY CONTROL

A. Testing:

1. Analyze existing and imported topsoil to determine percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and its pH value.
2. After testing, provide recommendation for fertilizer and lime application rates for specified seed mix.
3. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, based on test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify prepared soil base is ready to receive the Work of this Section.
B. Protect all existing structures and plantings, utilities, pavements, lawns, and other Site improvements from damage due to fine grading and installation of seed.

3.2 APPLICATION OF LIME

A. Apply lime at application rate recommended by soil analysis to achieve a pH of 6.0 to 6.5.
B. Apply lime at application rate of maximum 1 lb./sq. yd.
C. Work lime into top 6 inches of soil.

3.3 APPLICATION OF FERTILIZER

A. Apply fertilizer at application rate recommended by soil analysis.
B. Apply fertilizer at application rate of 5 lb. or more per sq. yd. based on soil test reports. Apply fertilizer in one operation with hydroseeding and fiber mulch.

C. Apply after smooth raking of topsoil .
D. Do not apply fertilizer at same time or with same machine used to apply seed.
E. Mix fertilizer thoroughly into upper 2 inches of topsoil.
F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.
G. Submit slow-release fertilizers and organic fertilizers within 25 feet of the wetland limit.

3.4 APPLICATION OF SEEDING

A. Apply seed at rate of 3 to 4 lb./1,000 sq. ft. evenly in two intersecting directions. Rake in lightly.
B. Do not seed areas in excess of that which can be mulched on same day.
C. Apply seed within planting seasons, which are April 1 to June 1 and August 15 to October 15.
D. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.
E. Roll seeded area with roller not exceeding 112 lb./linear foot.
F. Immediately following seeding and compacting, apply oat or wheat straw or mulch to thickness of minimum 1/8 inch. Maintain clear of shrubs and trees.
G. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.5 APPLICATION OF HYDROSEEDING

A. Apply fertilizer, mulch, and seeded slurry with hydraulic seeder at rate of 47-lb/1,000 sq. ft. evenly in one pass.
B. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

3.6 PROTECTION

A. Identify seeded areas with stakes and string around area periphery. Set string height to 12 inches. Space stakes at 10 feet.
B. Cover seeded slopes where grade exceeds minimum 4 in./1 ft. or greater with erosion fabric. Roll erosion fabric onto slopes without stretching or pulling.
C. Lay erosion fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth; level with adjacent soil.
D. Secure outside edges and overlaps at 36-inch intervals with stakes.
E. Lightly dress slopes with topsoil to ensure close contact between erosion fabric and soil.
F. At sides of ditches, lay erosion fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.7 MAINTENANCE SERVICE

A. Maintain seeded areas for three months from date of Substantial Completion.
B. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition for two cuttings.
C. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.
D. Neatly trim edges and hand clip where necessary.
E. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.
F. Water to prevent grass and soil from drying out.
G. Roll surface to remove minor depressions or irregularities.
H. Control growth of weeds. Apply herbicides and remedy any damage resulting from improper use of herbicides.
I. Immediately reseed areas showing bare spots.
J. Repair washouts or gullies.
K. Protect seeded areas with warning signs during maintenance period.

END OF SECTION 32 92 19

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SECTION 32 92 23 - SODDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Turfgrass sod.
2. Topsoil.

B. Related Requirements:

1. Section 310513 "Soils for Earthwork" for topsoil material.
2. Section 312213 "Rough Grading" for rough grading of Site.
3. Section 312316.13 "Trenching" for rough grading over cut.
4. Section 312323 "Fill" for rough grading of Site.
5. Section 329119 "Landscape Grading" for preparation of subsoil and placement of topsoil in preparation for Work of this Section.
6. Section 329219 "Seeding" for seeding and soil supplements.
7. Section 329300 "Plants" for interior and exterior landscaping.

1.2 DEFINITIONS

A. Fertilizer: A natural or artificial substance that, when added to topsoil or sod, improves content and enhances growth of turfgrass sod.
B. NALP: National Association of Landscape Professionals.
C. NTEP: National Turfgrass Evaluation Program.
D. Turfgrass Sod Quality: The two categories with specific characteristics that comprise the type of turfgrass sod to be used in the Project, as follows:

1. Commercial Grade Quality: A type of turfgrass sod that is of sufficient density so that no surface soil is visible at a mowed height of 1.5 inches; may contain up to 10 percent undesirable grass species and 10 weeds per 50 sq. yd.; whose sod soil thickness should not exceed one-half inch.
2. Premium Quality: A type of turfgrass sod that is of sufficient density so that no surface soil is visible at a mowed height of 1.5 inches, with maximum mowing height of 2.5 inches; contains not more than one percent undesirable grass or clover and not more than two weeds per 50 sq. yd.; whose sod soil thickness should not exceed one-half inch; also called "Number One (No. 1) quality."

E. TPI: Turfgrass Producers International.
F. TTG: The Turfgrass Group.
G. Weeds: A vegetative species other than species specified to be established in given area. Examples include dandelion, jimsonweed, quackgrass, horsetail, morning glory, rush grass, mustard, lambsquarter, chickweed, cress, crabgrass, Canadian thistle,

nutgrass, poison oak, blackberry, tansy ragwort, Bermuda grass, Johnson grass, poison ivy, nimblewill, bindweed, bentgrass, wild garlic, perennial sorrel, and brome grass.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

1. For Turfgrass Sod: Include turfgrass sod producer's information for sod grass species, mixture, and grade.
2. For Fertilizers: Include slow and fast release and starter fertilizer types, as well as manufacturers' literature and analysis with recommended rates in accordance with soil tests and Site requirements.
3. For Accessories: Include data for mulch, lime, and other accessories.
4. For Herbicides: Include product label and manufacturer's written application instructions specific to Project.

1.4 INFORMATIONAL SUBMITTALS

A. Turfgrass Sod Producer's Certificate: Certify that sod grass meets or exceeds specified TPI premium quality requirements.
B. Test and Evaluation Reports: Indicate topsoil nutrient and pH levels, with recommended soil supplements and application rates.
C. Source Quality-Control Reports: For turfgrass sod and accessories.
D. Qualifications Statements: For turfgrass sod producer, manufacturer, and installer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Submit maintenance instructions, cutting method, and maximum grass height.
2. Submit fertilizer types, application frequency, and recommended coverage.

1.6 QUALITY ASSURANCE

A. Turfgrass Sod: Test by holding upper two corners and suspend vertically to ensure that root development can support its own weight without tearing.

1. Age: Minimum two years old from time of original seeding.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver turfgrass sod in rolls.

2. Do not deliver more turfgrass sod than can be laid within 24 hours.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
C. Storage: Store materials in accordance with manufacturer's written instructions.
D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Keep turfgrass sod in a shaded area and covered with tarps to protect it from direct sunlight and drying winds. Protect exposed roots from dehydration.
3. Provide additional protection in accordance with manufacturer's written instructions.

1.8 FIELD CONDITIONS

A. Minimum Conditions: Do not place turfgrass sod when temperature is lower than 32 degrees F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work in accordance with:

1. The State of Pennsylvania Department of Transportation standards.

2.2 TURFGRASS SOD

A. Turfgrass Sod Producers:

1. Refer to TPI for acceptable turfgrass sod producers.

B. Description:

1. Cultivated turfgrass sod with strong fibrous root system, free of stones and burned or bare spots, in accordance with one or more of TPI's published turfgrass quality standards.
2. Type: As indicated below.
3. Weed Density: No more than two weeds per 50 sq. yd.
4. Percentage Grass Type:

a. Kentucky Bluegrass: 15 percent.
b. Rhizomatous Tall Fescue: 15 percent.

C. Harvesting of Turfgrass Sod:

1. Machine-cut turfgrass sod and load on pallets in accordance with TPI's published specifications for turfgrass sod materials, harvesting, handling, and installation.
2. Cut turfgrass sod , with minimum 1/2-inch and maximum 1-inch topsoil base.
3. Allowable Size Deviation:

    a. Width: 0.5 inch.
    b. Length: Plus or minus five percent.

2.3 TOPSOIL

A. Imported Topsoil:

1. As specified in Section 310513 "Soils for Earthwork".

B. Existing Site Topsoil: Excavated from Site and free of weeds.

2.4 ACCESSORIES

A. Fertilizer:

1. Grade: Commercial.
2. Description: As recommended for turfgrass sod, with 50 percent of elements derived from organic sources.
3. Proportions:

    a. As necessary to eliminate deficiencies of topsoil.
    b. Nitrogen: 10 percent.
    c. Phosphoric Acid: 10 percent.
    d. Soluble Potash: 10 percent.

B. Lime: ASTM C602, Class O agricultural limestone containing a minimum 85 percent calcium carbonate equivalent, with 50 percent passing the 100 mesh sieve and 95 percent passing the 20 mesh sieve.
C. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of grass.
D. Herbicide: Provide pre-emergent herbicide for controlling the germination or growth of weeds within turfgrass sodded areas .

2.5 SOURCE QUALITY CONTROL

A. Testing:

1. Analyze existing and imported topsoil to determine percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and its pH value.
2. After testing, provide recommendation for fertilizer and lime application rates for specified turfgrass sod species.

3. Do not require testing when recent tests are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that prepared soil base is ready to receive Work of this Section.
B. Protect all existing structures and plantings, utilities, pavements, lawns, and other Site improvements from damage due to fine grading and installation of turfgrass sod.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION OF LIME

A. Apply lime at application rate recommended by soil analysis to achieve a pH of 6.0 to 6.5.
B. Apply lime at application rate of maximum 1 lb./sq. yd.
C. Work lime into top 6 inches of soil.

3.3 APPLICATION OF FERTILIZER

A. Apply fertilizer at application rate recommended by soil analysis.
B. Apply fertilizer at application rate of 5 lb. or more per sq. yd. based on soil test reports.
C. Apply fertilizer after smooth raking of topsoil . Apply fertilizer no more than 48 hours before laying turfgrass sod.
D. Mix fertilizer thoroughly into upper 2 inches of topsoil.
E. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.4 INSTALLATION OF TURFGRASS SOD

A. Subsoil Preparation:

1. Eliminate uneven areas and low spots.
2. Maintain indicated lines, levels, profiles, and contours.
3. Slopes:

    a. Make gradual changes in grade.
    b. Blend slopes into level areas.

4. Foreign Materials:

    a. Remove foreign materials and undesirable plants and their roots.
    b. Do not bury foreign materials beneath areas to be sodded.

5. Remove contaminated subsoil.
6. Scarify subsoil to depth of 4 inches where topsoil is to be placed.
7. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

B. Placement of Topsoil:

1. Spread topsoil to minimum depth of 3 inches over area to be sodded.
2. Place topsoil during dry weather and on dry unfrozen subgrade.
3. Remove vegetative matter and foreign nonorganic material from topsoil while spreading.
4. Grade topsoil to eliminate rough, low, or soft areas, and to ensure positive drainage.
5. Install edging at periphery of sodded areas in straight lines to consistent depth.

C. Laying of Turfgrass Sod:

1. Moisten prepared surface immediately prior to laying turfgrass sod.
2. Lay turfgrass sod within 24 after harvesting to prevent deterioration.
3. Starter Strip: Lay the first row of turfgrass sod in a straight line, with subsequent rows placed parallel to and tightly against each other.
4. Joints:

    a. Lay turfgrass sod tightly with no open joints visible and no overlapping.
    b. Stagger end joints minimum 24 inches.
    c. Do not stretch or overlap turfgrass sod pieces.

5. Lay smooth and align with adjoining grass areas.
6. Place top elevation of turfgrass sod 1/2 inch below adjoining paving curbs and sidewalks.

7. Watering:

    a. Water sodded areas immediately after installation.
    b. Saturate turfgrass sod to 4 inches of soil.

3.5 MAINTENANCE SERVICE

A. Provide service and maintenance of turfgrass sodded areas for three months from date of Substantial Completion.
B. Maintain turfgrass sodded areas immediately after placement until grass is well established and exhibits vigorous growing condition.
C. Mowing:

1. Mow grass at regular intervals to maintain at maximum height of 3-1/2 inches.
2. Do not cut more than one-third of grass blade at each mowing.
3. Neatly trim edges and hand-clip where necessary.
4. Immediately remove clippings after mowing and trimming.

D. Water to prevent grass and soil from drying out.
E. Roll surface to remove irregularities.
F. Weed Control:

1. Control growth of weeds by applying herbicides.
2. Remedy damage resulting from improper use of herbicides.

G. Immediately replace turfgrass sod on areas showing deterioration or bare spots.
H. Protect turfgrass sodded areas with warning signs during maintenance period.

END OF SECTION 32 92 23

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SECTION 32 93 00 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.2 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Plant materials.
2. Fertilizers.
3. Weed-control barriers.
4. Mulches.
5. Herbicides and pesticides.
6. Tree-stabilization materials.
7. Landscape edgings.

B. Product Data Submittals: For each product.

1. Plant Materials: Include quantities, sizes, quality, and verified sources for plant materials.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of manufactured product, from manufacturer, and complying with manufacturer's certified analysis of standard products.
B. Pesticides and Herbicides: Product label and manufacturer's written application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Member in good standing of either the National Association of Landscape Professionals or AmericanHort.
2. Installer's Field Supervision: Maintain an experienced full-time supervisor on Project site when work is in progress.

3. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1. Selection of plants purchased under allowances is made by Architect, who tags plants at their place of growth before they are prepared for transplanting.

C. Measurements: Measure in accordance with ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs

immediately from Project site.

1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, or walkways and pavements; or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
D. Handle planting stock by root ball.
E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

G. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
H. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 15 to May 15.
2. Fall Planting: September 15 to November 15.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions in accordance with manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
   b. Structural failures, including plantings falling or blowing over.
   c. Faulty performance of tree stabilization.
   d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods: From date of planting completion.

   a. Trees, Shrubs, Vines, and Ornamental Grasses: 18 months.
   b. Ground Covers, Biennials, Perennials, and Other Plants: 18 months.
   c. Annuals: 18 months.

3. Include the following remedial actions as a minimum:

   a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
   b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
   c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
   d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; with tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); with crossing trunks; with cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare in accordance with ANSI Z60.1.

D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for plant.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to ensure symmetry in planting.

F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but are not yet in bloom.

2.2 FERTILIZERS

A. Granular Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition:

a. Nitrogen, phosphorous, and potassium in amounts recommended in soil

reports from a qualified soil-testing laboratory.

2.3 WEED-CONTROL BARRIERS

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers inert to biological degradation and naturally resistant to chemicals, alkalis, and acids, formed into a stable network so that fibers retain their relative position.

2.4 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Double shredded, aged hardwoods, not decomposed.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

B. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:

1. Type: Rounded riverbed gravel or smooth-faced stone.
2. Size Range: 3 inches maximum, 2 inches minimum.

2.5 HERBICIDES AND PESTICIDES

A. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
B. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.
C. Pesticides: Registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended in writing by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.6 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood or softwood with specified wood pressure-preservative treatment, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
2. Wood Deadmen: Timbers measuring 8 inches in diameter and 48 inches long, treated with specified wood pressure-preservative treatment.
3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach

stakes or turnbuckles.
4. Guys and Tie Wires: ASTM A641/A641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
5. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
6. Guy Cables: Five-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
7. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.7 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix in accordance with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until moisture content reaches acceptable levels to attain required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove soil and contamination as directed by Architect and replace with new planting soil.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake

locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil in accordance with Section 329113 "Soil Preparation."
B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.
C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
D. Application of Mycorrhizal Fungi: At time directed by Landscape Architect, broadcast dry product uniformly over prepared soil at application rate in accordance with manufacturer's written instructions.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately two times as wide as ball diameter for balled and burlapped container-grown stock.
3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
4. Do not excavate deeper than depth of root ball, measured from the root flare to the bottom of root ball.
5. If area under the plant was initially dug too deep, add soil to raise it to correct level and thoroughly tamp the added soil to prevent settling.
6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
7. Maintain supervision of excavations during working hours.
8. Keep excavations covered or otherwise protected overnight.

B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.
C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball in accordance with ANSI Z60.1. If root flare is not visible, remove soil in a level manner from root ball to where the top-most root emerges from the trunk. After soil removal to expose root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Backfill: Planting soil . For trees, use excavated soil for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Distribute granular fertilizer around each planting pit when pit is approximately one-half filled. Do not place in bottom of the hole.

    a. Quantity: As indicated by product manufacturer.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Backfill: Planting soil . For trees, use excavated soil for backfill.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Distribute granular fertilizer around each planting pit when pit is approximately one-half filled. Do not place in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of root ball.

3.6 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.
B. Do not apply pruning paint to wounds.

3.7 INSTALLATION OF TREE-STABILIZATION MATERIALS

A. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than 14 ft. in height and more than 3 inches in caliper unless otherwise indicated.

1. Site-Fabricated, Staking-and-Guying Method: Install no fewer than three guys spaced equally around tree.

    a. Securely attach guys to stakes 30 inches long, driven to grade. Adjust spacing to avoid penetrating root balls or root masses. Provide turnbuckle for each guy wire and tighten securely.
    b. Support trees with guy cable, connected to brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
    c. Attach flags to each guy wire, 30 inches above finish grade.

2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and in accordance with manufacturer's written instructions.

3.8 INSTALLATION OF ROOT BARRIER

A. Install root barrier where trees are planted within 48 inches of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.
B. Align root barrier vertically, and run it linearly along and adjacent to paving or other hardscape elements to be protected from invasive roots.
C. Install root barrier continuously for distance of 60 inches in each direction from tree trunk, for total distance of 10 ft. per tree. If trees are spaced closer, use single continuous piece of root barrier.

1. Position top of root barrier flush with finish grade.
2. Overlap root barrier minimum of 12 inches at joints.
3. Do not distort or bend root barrier during construction activities.
4. Do not install root barrier surrounding the root ball of tree.

3.9 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.
D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to depth not less than two nodes.
E. Work soil around roots to eliminate air pockets and leave slight saucer indentation around plants to hold water.
F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.10 INSTALLATION OF MULCHES

A. Install weed-control barriers before mulching in accordance with manufacturer's written instructions. Completely cover area to be mulched, overlapping edges minimum of 12 inches, and secure seams with galvanized pins.
B. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees and Treelike Shrubs in Turf Areas: Apply organic mulch ring of minimum 4-inch and maximum 6-inch average thickness, with 12-inch radius around trunks or stems. Do not create a mulch cone or place mulch within 3 inches of trunks or stems.
2. Organic Mulch in Planting Areas: Apply minimum 4-inch and maximum 6-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.
3. Mineral Mulch in Planting Areas: Apply minimum 4-inch and maximum 6-inch average thickness of mineral mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.11 APPLICATION OF HERBICIDES AND PESTICIDES

A. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written instructions. Do not apply to seeded areas.
B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written instructions.
C. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and in accordance with manufacturer's written instructions. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.12 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to

establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.13 REPAIR AND REPLACEMENT

A. Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Remove and replace trees that are more than 25 percent dead or in unhealthy condition before end of corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced for each tree of 6 inches or smaller in caliper size.
2. Provide one new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
3. Species of Replacement Trees: Species selected by Architect.

3.14 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

END OF SECTION 32 93 00

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SECTION 33 01 10.58 - DISINFECTION OF WATER UTILITY PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Disinfection of water lines per Aqua Pennsylvania Standards.

B. Related Requirements:

1. Section 331416 "Site Water Utility Distribution Piping" for product and execution requirements for installation and testing of Site domestic water distribution piping.

1.2 INFORMATIONAL SUBMITTALS

A. Certify that final water complies with disinfectant quality standards of Aqua Pennsylvania.
B. Material Test Reports: For each disinfectant and neutralizing agent, by a qualified testing agency.
C. Field Quality-Control Reports: For disinfection chemicals and neutralizing agents.
D. Qualifications Statements: For manufacturer and installer.

1.3 CLOSEOUT SUBMITTALS

A. Disinfection and Neutralization Reports:

1. Type and form of product(s) used.
2. Date and time of disinfectant injection start and completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual in flushed water in ppm.
8. Disinfectant residual after flushing in ppm for each outlet tested.
9. Chlorine residual in ppm in discharge water.
10. Chlorine neutralization discharge report.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's packaging; include installation and application instructions.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
C. Store in accordance with manufacturer instructions.
D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection in accordance with manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work in accordance with:

1. Aqua Pennsylvania standards.

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. Verify that piping system has been cleaned, inspected, and pressure tested.
C. Verify that pipe connections and their required access fittings have been installed under Section 331413 "Public Water Utility Distribution Piping" or Section 331416 "Site Water Utility Distribution Piping."
D. Perform scheduling and disinfecting activity with startup, water pressure testing, adjusting and balancing, and demonstration procedures, including coordination with related systems.
E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Coordinate preparation, testing, and discharge with Aqua Pennsylvania .
C. Disinfection, Flushing, and Sampling:

1. Disinfect pipeline installation in accordance with Aqua Pennsylvania requirements.
2. Use of liquid chlorine is not permitted.
3. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.

4. Disposal:

   a. Legally dispose of chlorinated water.

5. After final flushing and before pipeline is connected to existing system or placed in service, certify that disinfectant level meets quality standards of Aqua Pennsylvania.

D. Prepare test, inspection, and discharge reports.

END OF SECTION 33 01 10.58

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SECTION 33 01 30.86 - MANHOLE RIM ADJUSTMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manhole frames and covers.
2. Riser rings.

B. Related Requirements:

1. Section 034100 "Precast Structural Concrete" for execution requirements for precast and prestressed concrete members as specified in this Section.
2. Section 321216 "Asphalt Paving" for restoration of bituminous paving areas.
3. Section 329119 "Landscape Grading" for restoration of grassed areas.
4. Section 329219 "Seeding" for restoration of grassed areas.
5. Section 333100 "Sanitary Sewerage Piping" for execution requirements for sewerage piping as required by this Section.

1.2 SCHEDULING

A. Submit schedule for manhole grade adjustments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Submit manufacturer information for manhole covers and riser rings construction, features, configuration, dimensions and cover design.

1.4 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For manhole covers and riser rings.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual grade-adjusted elevation of manholes.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect

for damage.

B. Store materials according to manufacturer's instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

2.2 MANHOLE COMPONENTS

A. Manhole Frames and Covers:

1. Sanitary Sewer Basis-of-Design Product: Provide East Jordan Iron Works, Product No. 1045Z1 and relevant technical details including physical, functional, or performance characteristics of the named product than an "equal" item must meet to be deemed acceptable from one of the following:

   a. EJ Group, Inc.
   b. Neenah Foundry Company
   c. American Cast Iron Products, Inc.

2. Storm Sewer (Solid Cover) Basis-of Design Product: Provide East Jordan Iron Works, Product No. 1377A and relevant technical details including physical, functional, or performance characteristics of the named product than an "equal" item must meet to be deemed acceptable from one of the following:

   a. EJ Group, Inc.
   b. Neenah Foundry Company
   c. American Cast Iron Products, Inc.

3. Material: Cast iron.
4. Comply with ASTM A48/A48M, Class 35B.
5. Surface: Machined flat bearing.
6. Lid: Removable.
7. Cover Design: As indicated on the Drawings.
8. Live Load Rating: HS-20 Rated.
9. Furnish sealing gasket.
10. Cover: Molded with identifying name Sanitary Sewer or Storm Sewer as indicated on the Drawings.

B. Riser Rings:

1. Riser Ring Design Criteria:

a. Thickness of 4 Inches (100 mm) to 6 Inches (150 mm):

1) Material: Precast concrete.
2) Comply with ASTM C478.

b. Thickness of Less than 4 Inches (100 mm):

1) Material: Cast iron.
2) Comply with AASHTO M306.

c. Rubber Seal Wraps:

1) Wraps and Band Widths: Comply with ASTM C877, Type III.
2) Cone/Riser Ring Joint: Minimum 3-inch overlap.
3) Frame/Riser Ring Joint: 2-inch overlap.
4) Additional Bands: Overlap upper band by 2 inches.

2. Clay Brick Units:

a. Solid units.
b. Comply with ASTM C32 or AASHTO M91.
c. Grade: .

1) SM for Sanitary Sewer Applications.
2) MS for Storm Sewer Applications.

3. Accessories:

a. Joint Sealant: Comply with ASTM C990.
b. Bolts: Stainless steel; ASTM F593.

2.3 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify and locate manholes requiring grade adjustment.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF MANHOLE FRAMES AND COVERS

A. Raising Manhole Frames and Covers:

1. Locate and raise manholes to grade as indicated on Drawings.
2. Reinstall removed manhole frame and cover.

B. Replacing Manhole Frames and Covers:

1. Locate manholes for replacement of frames and covers as indicated on Drawings.
2. Remove existing manhole frames and covers to enable reuse.
3. Deliver removed manhole frames and covers to Owner as maintenance materials.
4. Install new frames and covers for manholes as indicated on Drawings.
5. Adjust new frames and covers to match finished grade as indicated on Drawings.
6. Seal joints between manholes and manhole frames.

C. Paving Restoration: Restore bituminous paving areas as specified in Section 321216 "Asphalt Paving."
D. Landscaping Restoration: Restore grassed areas as specified in Sections 329119 "Landscape Grading" and 329219 "Seeding."

END OF SECTION 33 01 30.86

SECTION 33 05 00 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping joining materials.
2. Sleeves.
3. Identification devices.
4. Grout.
5. Flowable fill.
6. Piped utility demolition.
7. Piping system common requirements.
8. Equipment installation common requirements.
9. Painting.
10. Concrete bases.
11. Metal supports and anchorages.

1.2 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
C. ABS: Acrylonitrile-butadiene-styrene plastic.
D. CPVC: Chlorinated polyvinyl chloride plastic.
E. PE: Polyethylene plastic.
F. PVC: Polyvinyl chloride plastic.

1.3 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.5 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.
C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

    1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

        a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
        b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

    2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.
E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
G. Solvent Cements for Joining Plastic Piping:

    1. ABS Piping: ASTM D2235.
    2. CPVC Piping: ASTM F493.

3. PVC Piping: ASTM D2564. Include primer according to ASTM F656.
4. PVC to ABS Piping Transition: ASTM D3138.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
B. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
2. Aboveground Piping: Specified piping system fitting.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

2.4 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Section 220500 "Common Work Results for Plumbing."
B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
F. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.
B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.

2. Location: Accessible and visible.

C. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

D. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material:

a. 0.032-inch- thick, polished brass or aluminum.
b. 0.0375-inch- thick stainless steel.
c. 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
d. Valve manufacturer's standard solid plastic.

2. Size: 1-1/2 inches in diameter, unless otherwise indicated.
3. Shape: As indicated for each piping system.

E. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

F. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

a. Name and plan number.
b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

G. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO

NOT OPERATE.

H. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.6 GROUT

A. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.
B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 (DN 50) and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Dielectric flanges or dielectric flange kits.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 (DN 50) and Smaller: Dielectric couplings or dielectric nipples.
2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric nipples.
3. NPS 2-1/2 to NPS 8 (DN 65 to DN 200): Dielectric nipples or dielectric flange kits.
4. NPS 10 and NPS 12 (DN 250 and DN 300): Dielectric flange kits.

3.3 INSTALLATION OF PIPING

A. Install piping according to the following requirements and utilities Sections specifying piping systems.
B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
D. Install piping to permit valve servicing.
E. Install piping at indicated slopes.
F. Install piping free of sags and bends.
G. Install fittings for changes in direction and branch connections.
H. Select system components with pressure rating equal to or greater than system operating pressure.
I. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

    a. Pipe Sleeves: PVC. For pipes smaller than NPS 6.
    b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

J. Verify final equipment locations for roughing-in.

K. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.
B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
H. Soldered Joints: Apply ASTM B813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B32.
I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 appendixes.
3. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
5. PVC Nonpressure Piping: Join according to ASTM D2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.
M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.
N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.6 INSTALLATION OF EQUIPMENT

A. Install equipment level and plumb, unless otherwise indicated.
B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
C. Install equipment to allow right of way to piping systems installed at required slope.

3.7 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Locate pipe markers on exposed piping according to the following:

a. Near each valve and control device.

b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
d. At manholes and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.9 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. 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 base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 055000 "Metal Fabrications" for structural steel.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.11 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
B. Clean surfaces that will come into contact with grout.
C. Provide forms as required for placement of grout.
D. Avoid air entrapment during placement of grout.
E. Place grout, completely filling equipment bases.
F. Place grout on concrete bases and provide smooth bearing surface for equipment.
G. Place grout around anchors.
H. Cure placed grout.

END OF SECTION 33 05 00

SECTION 33 05 09.33 - THRUST RESTRAINT FOR UTILITY PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Thrust restraint systems.
B. Related Requirements:

1. Section 312316.13 "Trenching" for trenching and backfilling requirements for Site utilities.
2. Section 331416 "Site Water Utility Distribution Piping" for requirements for piping Work as required by this Section.
3. Section 333100 "Sanitary Sewerage Piping" for requirements for piping Work as required by this Section.

1.2 COORDINATION

A. Coordinate Work of this Section with installation of fittings and joints that require restraint.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of joint restraints.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
B. Store materials according to manufacturer instructions.
C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

B. Provide pressure pipeline with restrained joints at each bend, tee, and change in direction.

2.2 THRUST RESTRAINT

A. Provide thrust restraint in accordance with methods outlined. Length of restraint as indicated on Drawings.

1. Concrete Thrust Blocks and Tie Rods: Details as shown on drawings. Concrete shall comply with PADOT Publication 408, Section 704, Type C (3,300 psi compressive strength at 28 days). Tie rods shall be constructed of suitable metal. Metal harness of tie rods shall be galvanized or otherwise rust proofed and shall be painted with bituminous coating after installation.
2. Concrete Thrust Blocks and Tie Rods: Details as shown on drawings. Concrete shall comply with PADOT Publication 408, Section 704, Type C (3,300 psi compressive strength at 28 days). Tie rods shall be constructed of suitable metal. Metal harness of tie rods shall be galvanized or otherwise rust proofed and shall be painted with bituminous coating after installation.

    a. Megalug retainer gland equivalent to EBAA Iron, Inc Series 1100 MEGALUG or 2000PV MEGALUG.

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. Examine roughing-in for thrust restraint for utility piping to verify actual locations of piping connections before equipment installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

END OF SECTION 33 05 09.33

SECTION 33 05 61 - CONCRETE MANHOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete and masonry manholes.
2. Frames and covers.
3. Riser rings.

B. Related Requirements:

1. Section 310513 "Soils for Earthwork" for soils for backfill in trenches.
2. Section 310516 "Aggregates for Earthwork" for aggregate for backfill in trenches.
3. Section 310519.13 "Geotextiles for Earthwork" for filter fabric for subsurface drainage.
4. Section 312316 "Excavation" for excavating for manholes, structures, and foundation slabs.
5. Section 312323 "Fill" for backfilling after manhole and structure installation.
6. Section 330130.86 "Manhole Rim Adjustment" for resetting existing castings and grates.
7. Section 333100 "Sanitary Sewerage Piping" for piping connections to manholes.
8. Section 334200.01 "Stormwater Conveyance for Infrastructure" for piping connections to manholes and structures.

1.2 DEFINITIONS

A. Bedding: A type of specialized material placed under manhole prior to installation and subsequent backfill operations.

1.3 COORDINATION

A. Coordinate Work of this Section with connection to municipal sewer utility service and trenching.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Concrete and masonry manholes.
2. Frames and covers.
3. Riser rings.

B. Shop Drawings:

1. Indicate structure locations and elevations.
2. Indicate sizes and elevations of piping, penetrations, frames, covers, , and sections.
3. Signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For manholes and covers.
B. Field Quality-Control Reports: For manholes and covers.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of manholes and connections, and record invert elevations.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: PennDOT Bulletin 15 approved.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
B. Handling: Comply with precast concrete manufacturer instructions and ASTM C913 for unloading and moving precast manholes and drainage structures.
C. Storage:

1. Store materials according to manufacturer instructions.
2. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
3. Repair property damaged from materials storage.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote

from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

2.2 MANHOLES

A. Concrete and Masonry Manholes:

1. Manufacturers:

a. Monarch Products, Inc.
b. A.C. Miller Concrete Products, Inc.
c. Terre Hill Concrete Products

2. Clear Inside Dimensions:

a. As indicated on Drawings.

3. Design Depth:

a. As indicated on Drawings.

4. Clear Cover Opening:

a. As indicated on Drawings.

5. Pipe Entry: Furnish openings as indicated on Drawings.
6. Structure Joint Gaskets:

a. Comply with ASTM C361.
b. Material: Rubber.

B. Frames and Covers:

1. Manufacturers:

a. EJ Group, Inc.
b. Neenah Foundry Company
c. Woodward Foundries, Inc.

2. Material:

a. Cast iron.
b. Comply with ASTM A48/A48M, Class 30B.

3. Lid:

a. Bearing Surface: Machined flat.
b. Configuration: Removable.
c. Security: Boltable.

4. Cover Design: Waterproof.
5. Loading: H-20; AASHTO HB-17.
6. Furnish sealing gasket.
7. Identification: Cast with wording as indicated on Drawing Details with raised letters. Letters shall have a height and width of not less than two (2) inches.
8. Grate: Bicycle safe.
9. Lid or Grate Diameter: As indicated on Drawings.

C. Riser Rings:

1. Riser Rings:

a. Thickness of 4 to 6 Inches (100 to 150 mm):

1) Precast concrete.
2) Comply with ASTM C478.

b. Thickness Less Than 4 Inches (100 mm):

1) Cast iron.
2) Comply with AASHTO M306.

c. Rubber Seal Wraps:

1) Wraps and Band Widths: Comply with ASTM C877, Type III.
2) Cone/Riser Ring Joint: Minimum 3-inch overlap.
3) Frame/Riser Ring Joint: 2-inch overlap.
4) Additional Bands: Overlap upper band by 2 inches.

2. Clay Brick Units:

a. Comply with ASTM C32.
b. Grade: .

1) SM for Sanitary Sewer Applications.
2) MS for Storm Sewer Applications.

c. Configuration: Solid.

2.3 MATERIALS

A. Cover and Bedding:

1. Cover: Fill Type , as specified in Section 310516 "Aggregates for Earthwork".

B. Coarse Aggregate Bedding: ASTM C33, No. 57 Stone.
C. Masonry Morter: ASTM C270, Type 3.
D. Concrete: PennDOT Class AA, Modified, 4,000 PSI.

2.4 ACCESSORIES

A. Steps:

1. Rungs: Formed Grade 60 Steel.
2. Fabrication: Formed integral with manhole sections.
3. Diameter: As indicated on Drawings.
4. Width:

a. As indicated on Drawings.

5. Spacing:

a. As indicated on Drawings.

2.5 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

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. Examine ground areas for suitable conditions where concrete manholes will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.
B. Coordinate placement of inlet and outlet pipe or duct sleeves as required by other Sections.
C. Do not install manholes and structures where Site conditions induce loads exceeding structural capacity of manholes or structures.
D. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

3.3 INSTALLATION OF CONCRETE AND MASONRY MANHOLES

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface structures or utilities in immediate or adjacent areas.
B. Remove large stones or other hard matter impeding consistent backfilling or compaction.
C. Protect manhole from damage or displacement while backfilling operation is in progress.
D. Excavating:

1. As specified in Section 312316 "Excavation" and in indicated locations and depths.
2. Provide clearance around sidewalls of manhole or structure for construction operations , granular backfill,.
3. If ground water is encountered, prevent accumulation of water in excavations; place manhole or structure in dry trench.
4. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation as approved by Architect/Engineer.

E. Base and Alignment:

1. Place manhole sections plumb and level, trim to correct elevations, and anchor to foundation slab.
2. Install manholes supported at proper grade and alignment on compacted crushed-stone bedding.
3. Form and place manhole or structure cylinders plumb and level, to correct dimensions and elevations.

F. Attachments:

1. Set cover frames and covers level to correct elevations without tipping.

G. Backfilling: As specified in Section 312323 "Fill."
H. Precast Concrete Manholes:

1. Lift precast components at lifting points designated by manufacturer.
2. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
3. Assembly:

    a. Assemble multisection manholes and structures by lowering each section into excavation.
    b. Install rubber gasket joints between precast sections according to manufacturer recommendations.
    c. Lower, set level, and firmly position base section before placing additional sections.

4. Remove foreign materials from joint surfaces and verify that sealing materials are placed properly.
5. Maintain alignment between sections by using guide devices affixed to lower section.
6. Joint sealing materials may be installed on Site or at manufacturer's plant.
7. Verify that installed manholes and structures meet required alignment and grade.
8. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.
9. Cut pipe flush with interior of structure.
10. Shape inverts through manhole and structures as indicated on Drawings.

I. Doghouse Manholes and Structures:

1. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.
2. Carefully excavate around existing sewer line to adequate depth for foundation slab installation.
3. Protect existing pipe from damage.
4. Cut out soft spots and replace with granular fill compacted to 95 percent maximum density.
5. Bear firmly and fully on compacted crushed stone bedding.
6. Install precast concrete manhole or structure around existing pipe according to applicable Paragraphs in this Section.
7. Grout pipe entrances as specified in Section 033000.01 "Cast-in-Place Concrete for Infrastructure".
8. Block upstream flow at existing manhole or structure with expandable plug.
9. Use hydraulic saw to cut existing pipe at manhole or structure entrance and exit and along pipe length at a point halfway up OD on each side of pipe.
10. Bottom half of pipe is to remain as manhole flow channel.
11. Saw cut to smooth finish with top half of pipe flush with interior of manhole or structure.
12. Grout base of manhole or structure to achieve slope to manhole or structure channel as specified in Section 033000.01 "Cast-in-Place Concrete for Infrastructure" and trowel smooth.

J. Sanitary Manhole Drop Connections:

1. As indicated on Drawings.

K. Castings:

1. Set frames using mortar and masonry as indicated on Drawings.
2. Install radially laid concrete brick with 1/4-inch- thick, vertical joints at inside perimeter.
3. Set frame and cover 2 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Tests and Inspections:

1. Cast-in-Place Concrete: As specified in Section 033000.01 "Cast-in-Place Concrete for Infrastructure".
2. Manholes shall be tested for leakage in accordance with Section 333100 "Sanitary Sewerage Piping".
3. Concrete Manhole Sections: Comply with ASTM C497.
4. Concrete manholes will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Vertical Adjustment of Existing Manholes and Structures:

1. As specified in Section 330130.86 "Manhole Rim Adjustment".
2. If required, adjust top elevation of existing manholes and structures to finished grades as indicated on Drawings.
3. Frames, Grates, and Covers:

    a. Remove frames, grates, and covers cleaned of mortar fragments.
    b. Reset to required elevation according to requirements specified for installation of castings.

4. Reinforcing Bars:

    a. Remove concrete without damaging existing vertical reinforcing bars if removal of existing concrete wall is required.
    b. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement as indicated on Drawings.

5. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete as specified in Section 033000.01 "Cast-in-Place Concrete for Infrastructure".

END OF SECTION 330561

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SECTION 33 14 16 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping.
2. Valves and hydrants.
3. Concrete encasement and cradles.

B. Related Requirements:

1. Section 033000.01 "Cast-in-Place Concrete for Infrastructure" for concrete for cradles and encasements.
2. Section 310513 "Soils for Earthwork" for soils for backfill in trenches.
3. Section 310516 "Aggregates for Earthwork" for aggregate for backfill in trenches.
4. Section 312316 "Excavation" for product and execution requirements for excavation and backfill.
5. Section 312316.13 "Trenching" for execution requirements for trenching.
6. Section 312323 "Fill" for requirements for backfill to be placed by this Section.
7. Section 330110.58 "Disinfection of Water Utility Piping Systems" for disinfection of water mains and appurtenances.
8. Section 330509.33 "Thrust Restraint for Utility Piping" for tied joint-restraint system to anchor and resist forces developed in underground closed pipeline systems.
9. Section 331419 "Valves and Hydrants for Water Utility Service" for fire hydrants, valves, and valve boxes for fire hydrant and water main installations.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Piping.
2. Concrete encasement and cradles.

1.3 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports: For piping and related equipment.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping mains, valves,

connections, thrust restraints, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Storage:

1. Store materials according to manufacturer instructions.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
4. Store PE and PVC materials out of sunlight.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.
2. Aqua Pennsylvania standards.

2.2 PIPING

A. Ductile Iron Pipe:

1. Comply with AWWA C151.
2. Cement Mortar Linings: Conforming to AWWA C104, except the thickness of the linings should be not less than the following:

   a. 3-in through 12-inch pipe ID: 1/8-inch
   b. 14-inch through 24-inch pipe ID: 3/16 inch.

3. Fittings:

   a. Material: Ductile iron.

1) Comply with AWWA C153.
2) All fittings shall have a minimum pressure rating of 350 PSI.
3) All fittings shall have cement lining and joints as required for pipe restraint.

b. Thickness: Standard.

4. Joints:

a. Comply with AWWA C111.
b. Provide rubber gasket with rods.

5. Jackets:

a. AWWA C105 PE jacket.

B. Copper Tubing:

1. Comply with ASTM B88.
2. Type K, annealed.
3. Fittings: ASME B16.18, cast copper.
4. Joints: Compression connection.

C. PVC Pipe with Cast Iron Fittings:

1. Cast Iron Fittings: Comply with AWWA C111.
2. Joints:

a. Comply with ASTM D3139.
b. Furnish compression gasket ring on bell end.

2.3 VALVES AND HYDRANTS

A. Valves, Valve Boxes, and Fire Hydrants: As specified in Section 331419 "Valves and Hydrants for Water Utility Service."

2.4 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. PennDOT Class A Concrete
2. Type: Reinforced, air entrained.
3. Compressive Strength: 3,300 psi at 28 days.
4. Finish: Rough troweled.

2.5 MATERIALS

A. Bedding and Cover:

1. Bedding: Fill Type as specified in Section 310516 "Aggregates for Earthwork".
2. Cover: Fill Type as specified in Section 310516 "Aggregates for Earthwork".
3. Soil Backfill from Above Pipe to Finish Grade:

a. Soil Type as specified in Section 310513 "Soils for Earthwork".
b. Subsoil with no rocks greater than 3 inches in diameter, frozen earth, or foreign matter.

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. Examine roughing-in for site water utility distribution piping to verify actual locations of piping connections before equipment installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
B. Remove scale and dirt on inside and outside before assembly.
C. Prepare pipe connections to equipment with flanges or unions.
D. Protect and support existing distribution piping and appurtenances as Work progresses.

3.3 INSTALLATION OF PIPING

A. Bedding:

1. Excavate pipe trench as specified in Section 312316.13 "Trenching".
2. Placement:

a. Place bedding material as indicated on Drawings.
b. Level fill materials in one continuous layer not exceeding 8 inches of compacted depth.
c. Compact to 95 percent maximum density.

3. Backfill around sides and to top of pipe as specified in Section 312323 "Fill."
4. Maintain optimum moisture content of fill material to attain required compaction

density.
5. Place fill materials as specified in Section 312323 "Fill."

B. Pipe and Fittings:

1. Maintain separation of water main from sewer piping and stormwater piping according to Aqua Pennsylvania requirements .
2. Group piping with other Site piping work whenever practical.
3. Install pipe to elevations indicated on Drawings.
4. Install ductile-iron piping and fittings according to AWWA C600.
5. Route pipe in straight line.
6. Install access fittings to permit disinfection of water system performed under Section 330110.58 "Disinfection of Water Utility Piping Systems".
7. Thrust Restraints:

    a. Form and place concrete for pipe thrust restraints at each elbow or change of pipe direction.
    b. Place concrete to permit full access to pipe and pipe accessories.
    c. Provide bearing area as indicated on Drawings.

8. Establish elevations of buried piping with not less than four (4) feet of cover.
9. Pipe Markers: As specified in Section 330597 "Identification and Signage for Utilities."
10. Valves, Valve Boxes, and Fire Hydrants: As specified in Section 331419 "Valves and Hydrants for Water Utility Service."

C. Disinfection: As specified in Section 330110.58 "Disinfection of Water Utility Piping Systems."

3.4 TOLERANCES

A. Install pipe within tolerance of 5/8 inch.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Tests and Inspections:

1. Pressure test piping system according to AWWA C600 and following:

    a. Test Pressure: Not less than 150 psig or 1.5 times in excess of maximum static pressure, whichever is greater.
    b. Conduct hydrostatic test for a minimum of two hours.
    c. Should any pressure test disclose an inability to hold the test pressure, the contractor shall locate and correct defects and retest to the satisfaction of the utility owner.

2. Compaction Testing:

a. Coordinate testing with Owner's Geotechnical Consultant.
b. Comply with ASTM D698 or ASTM D6938.
c. Frequency of Compaction Tests: One test at each structure and one test for each 150 lineal feet of pipe or fractions thereof per foot of backfill.
d. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 33 14 16

SECTION 33 14 19 - VALVES AND HYDRANTS FOR WATER UTILITY SERVICE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Valves.
2. Fire hydrants.
3. Valve boxes for water utility services.

B. Related Requirements:

1. Section 033000.01 "Cast-in-Place Concrete for Infrastructure" for concrete for thrust restraints.
2. Section 310516 "Aggregates for Earthwork" for fire hydrant drainage gravel.
3. Section 330110.58 "Disinfection of Water Utility Piping Systems" for requirements for flushing and disinfecting.
4. Section 330509.33 "Thrust Restraint for Utility Piping" for thrust restraints as required by this Section.
5. Section 331416 "Site Water Utility Distribution Piping" for pressure testing of valves and fire hydrants.

1.2 COORDINATION

A. Coordinate Work of this Section with installation of water mains.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Valves.
2. Fire hydrants.
3. Valve boxes for water utility services.

1.4 INFORMATIONAL SUBMITTALS

A. Source Quality-Control Reports: For valves, valve boxes, and fire hydrants.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and fire hydrants.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Tools: Furnish two (2) tee wrenches of required length to Owner.

1.7 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.
B. Cast manufacturer's name, pressure rating, and year of fabrication into valve body.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Seal ends of valves and fire hydrants to prevent entry of foreign matter.
2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.
C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.
2. Aqua Pennsylvania standards.

2.2 VALVES

A. Performance and Design Criteria:

1. Pressure Rating:

a. 12-inch (300-mm) Diameter and Smaller: 200 psig.
b. 14-inch (350-mm) Diameter and Larger: 150 psig.

2. End Connections: Flanged.
3. Furnish valves of diameters 16 inchesand larger with bypass valves and gear operators.
4. Coatings:

a. Comply with AWWA C550.
b. Application: Interior and exterior.

B. Resilient-Wedge Gate Valves:

1. Basis-of-Design Product: Provide U. S. Pipe and Foundry Co.; Metroseal 250 and relevant technical details including physical, functional, or performance characteristics of the named product that an "equal" item must meet to be deemed acceptable from one of the following:

a. American Cast Iron Pipe Company
b. Clow Valve Company; a subsidiary of McWane, Inc.
c. Mueller Co. LLC; Mueller Water Products, Inc.
d. NIBCO INC.
e. U. S. Pipe and Foundry Co.

2. Comply with AWWA C509.
3. Body: Ductile iron.
4. Seats: Resilient.
5. Stem:

a. Type: Non-rising.
b. Material: Bronze.
c. O-ring stem seals.

6. Operation:

a. Square operating nut (2-inch).
b. Opening Direction: Counterclockwise.

C. Valve Boxes for Water Utility Services:

1. Basis-of-Design Product: Provide Bingham and Taylor Co.; Model #4906 and relevant technical details including physical, functional, or performance characteristics of the named product that an "equal" item must meet to be deemed acceptable from one of the following:

a. Ford Meter Box Company, Inc. (The)
b. Mueller Co. LLC; Mueller Water Products, Inc.
c. Union Foundry Company acquired by McWane, Inc
d. Bingham and Taylor Co.; Model #4906

2. 12-inch (300-mm) Diameter Valves and Smaller:

a. Material: Cast iron.
b. Type: Two piece; screw.

3. Valves Larger than 12-inch (300-mm) Diameter:

a. Material: Cast iron.

b. Type: Three piece; screw.
c. Base: Round.

4. Valve Boxes

a. Comply with AWWA M44 for cast-iron, 3-piece screw type valve boxes.

1) Include top section, adjustable extension of length required for depth of burial of valve, and bottom section with base that fits over valve with a barrel approximately 5 inches in diameter.
2) Operating Wrenches:

a) Steel, tee-handle with one-pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

5. Lid Inscription: WATER .

2.3 FIRE HYDRANTS

A. Fire Hydrants:

1. Basis-of-Design Product: Provide ITT Kennedy Valve; Guardian K81D and relevant technical details including physical, functional, or performance characteristics of the named product that an "equal" item must meet to be deemed acceptable from one of the following:

a. American Cast Iron Pipe Company
b. Kennedy Valve Company; a division of McWane, Inc.
c. Mueller Co. LLC; Mueller Water Products, Inc.

2. Dry-Barrel, Breakaway Type:

a. Comply with AWWA C502.
b. Body: Cast iron.
c. Valve: Compression type.
d. Burial Depth:.

1) 5'-0" unless otherwise indicated on Drawings

e. Inlet Connection Size: 6 inches.
f. Valve Opening: 5-1/4 inches in diameter.
g. End Connections: Mechanical joint.
h. Bolts and Nuts: Galvanized steel.
i. Interior Coating: Comply with AWWA C550.
j. Operating Nut: Standard bronze, pentagon shaped with dirt shield.
k. Opening Direction: Counterclockwise.

3. Hose Connections:

a. One pumper, two hose nozzles.

1) The 5-inch hydrant pumper nozzle shall be of one-piece design, compatible with Storz quick-connect pumper connection. The nozzle shall be an integral part of the fire hydrant and must be furnished by the manufacturer or authorized distributor designated by the manufacturer. Storz adapters will not be accepted.
2) Two 2-1/2 inch hose nozzles.

b. Obtain thread type and size from local fire department.
c. Attach nozzle caps by separate chains.

4. Finishes:

a. Primer and two coats of enamel as recommended by manufacturer.
b. Color: Comply with requirements of fire department.

2.4 ACCESSORIES

A. Thrust Restraints: As specified in Section 330509.33 "Thrust Restraint for Utility Piping."
B. Valve Box Aligner: High-strength plastic device designed to automatically center valve box base and to prevent it from shifting off center during backfilling.
C. Fire Hydrant Drainage Gravel: As specified in Section 310516 "Aggregates for Earthwork."

2.5 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Determine exact location and size of valves from Drawings.
B. Identify required lines, levels, contours, and datum locations.
C. Verify that elevations of existing facilities prior to excavation and installation of valves and fire hydrants are as indicated on Drawings.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Locate, identify, and protect from damage utilities to remain.
B. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

1. Notify Architect/Engineer not less than seven (7) days in advance of proposed utility interruption.
2. Do not proceed without written permission from Architect/Engineer.

3.3 INSTALLATION OF VALVES

A. Perform trench excavation, backfilling, and compaction as specified in Section 312316.13 "Trenching".
B. Install valves in conjunction with pipe laying.
C. Provide buried valves with valve boxes installed flush with finished grade.
D. Orientation: Set valves plumb.
E. Disinfection of Water Piping System: Flush and disinfect valves with water mains as specified in Section 330110.58 "Disinfection of Water Utility Piping Systems."

3.4 INSTALLATION OF FIRE HYDRANTS

A. Perform trench excavation, backfilling, and compaction as specified in Section 312316.13 "Trenching".
B. Install fire hydrants in conjunction with pipe laying.
C. Provide support blocking and drainage gravel while installing fire hydrants; do not block drain hole.
D. Orientation:

1. Set fire hydrants plumb.
2. Set fire hydrants with pumper nozzle facing roadway.
3. Set fire hydrants with centerline of pumper nozzle 18 inches above finished grade and with safety flange not more than 6 inches nor less than 2 inches above grade.

E. After main-line pressure testing, flush fire hydrants and check for proper drainage.
F. Disinfection of Water Piping System: Flush and disinfect fire hydrants with water mains as specified in Section 330110.58 "Disinfection of Water Utility Piping Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Testing: Pressure test valves and hydrants with water mains as specified in Section 331416 "Site Water Utility Distribution Piping."

C. Prepare test and inspection reports.

END OF SECTION 33 14 19

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SECTION 33 31 00 - SANITARY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:

1. Section 310513 "Soils for Earthwork" for soil for backfill in trenches.
2. Section 310516 "Aggregates for Earthwork" for aggregate for backfill in trenches.
3. Section 312316 "Excavation" for requirements for excavation and backfill as required by this Section.
4. Section 312316.13 "Trenching" for requirements for trenching as required by this Section.
5. Section 312323 "Fill" for requirements for backfilling as required by this Section.
6. Section 330505.33 "Infiltration and Exfiltration Testing" for infiltration testing of gravity-flow sewerage piping.
7. Section 330505.43 "Mandrel Testing" for deflection testing of plastic sewerage piping.
8. Section 330561 "Concrete Manholes" for manholes for sanitary sewerage piping.

1.2 DEFINITIONS

A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

1.3 COORDINATION

A. Coordinate Work of this Section with termination of sanitary sewer connection outside building, connection to existing sanitary sewer as indicated on the Drawings, and trenching.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record finished locations of pipe runs, connections,

manholes, cleanouts, and invert elevations.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
B. Storage:

1. Store materials in accordance with manufacturer instructions.
2. Store valves in shipping containers with labeling in place.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Provide additional protection in accordance with manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work in accordance with:

1. The State of Pennsylvania Department of Transportation standards.
2. Bucks County Water and Sewer (BCWSA) standards.

2.2 SANITARY SEWERAGE PIPING

A. Ductile-Iron Pipe:

1. Comply with AWWA C151.
2. Minimum Special Thickness Class: 51.
3. End Connections: Bell and spigot.
4. Outside Coating:

a. Type: Asphaltic.
b. Minimum Uniform Thickness: 1 mil.
c. Comply with AWWA C151.

5. Cement Mortar Lining: Comply with AWWA C104.
6. Fittings:

a. Material: Ductile iron, Class 51 or greater.
b. Comply with AWWA C153.
c. Lining: Cement-mortar lined in accordance with AWWA C104.

7. Joints:

    a. Rubber gasket joint devices.
    b. Comply with AWWA C111.

B. Plastic Pipe with Bell and Spigot End Connections with Rubber-Ring-Sealed Gasket Joint:

1. Material: PVC.
2. Comply with ASTM D3034, SDR- 35.
3. Inside Nominal Diameter: As indicated on Drawings,
4. Fittings: PVC.
5. Joints:

    a. Elastomeric gaskets.
    b. Comply with ASTM F477.

C. Plastic Pipe for Piping Up to 12 Inches (300 mm) in Diameter:

1. Material: PVC, Schedule 40.
2. Comply with ASTM D1785.
3. Inside Nominal Diameter: As indicated on Drawings.
4. End Connections: Bell and spigot with solvent-sealed ends.
5. Fittings:

    a. Material: PVC.
    b. Comply with ASTM D2466.

6. Joints:

    a. Solvent welded with solvent cement in accordance with ASTM D2564.
    b. Comply with ASTM D2855.

2.3 MANHOLES

A. As specified in Section 330561 "Concrete Manholes."

2.4 MATERIALS

A. Bedding and Cover:

1. Bedding: Fill Type , as specified in Section 312316.13 "Trenching".
2. Cover: Fill Type , as specified in Section 312316.13 "Trenching".
3. Soil Backfill from Above Pipe to Finish Grade:

    a. Soil Type , as specified in Section 310513 "Soils for Earthwork".
    b. Subsoil with no rocks more than 3 inches in diameter, frozen earth, or foreign matter.

2.5 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of pipe.

B. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Verify that trench cut is ready to receive Work of this Section.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
B. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
C. Protect and support existing sewer lines, utilities, and appurtenances.
D. Utilities:

1. Maintain profiles of utilities.
2. Coordinate with other utilities to eliminate interference.
3. Notify Engineer if crossing conflicts occur.

3.3 INSTALLATION OF SANITARY SEWERAGE PIPING

A. Bedding:

1. Excavate pipe trench as specified in Section 312316.13 "Trenching".
2. Place bedding material at trench bottom.
3. Level materials in continuous layer not exceeding 6 inches.
4. Maintain optimum moisture content of bedding material to attain required compaction density.

B. Sanitary Sewerage Piping:

1. Install pipe, fittings, and accessories in accordance with ASTM D2321, and seal joints watertight.
2. Lay pipe to slope gradients as indicated on Drawings.
3. Begin at downstream end of system and progress upstream.
4. Bedding:

    a. As indicated on Drawings.

5. Lay bell-and-spigot pipe with bells upstream.
6. Backfill and compact as specified in Section 312316.13 "Trenching."
7. Do not displace or damage pipe when compacting.
8. Connect to building sanitary sewer outlet and municipal sewer system.
9. Pipe Markers: As specified in Section 330597 "Identification and Signage for Utilities."
10. Install Site sanitary sewage system piping to within 5 feet of building and connect to building sanitary waste system.

C. Backfilling:

1. As specified in Section 312323 "Fill."

3.4 INSTALLATION OF MANHOLES

A. Manholes: As specified in Section 330561 "Concrete Manholes."

3.5 TOLERANCES

A. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Request inspection by Owner's Geotechnical Consultant prior to and immediately after placing bedding.
C. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Perform testing on Site sanitary sewage system in accordance with Bucks County Water and Sewer standards.

3. Compaction Testing:

    a. Comply with ASTM D698 or ASTM D6938.
    b. Testing Frequency: One test at each structure and one test for each 150 lineal feet of pipe or fractions thereof per foot of backfill.

D. Prepare test and inspection reports.

3.7 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
B. Cap open ends of piping during periods of Work stoppage.

END OF SECTION 33 31 00

SECTION 33 31 15 - SITE SANITARY SEWERAGE PIPING

PART 1 - GENERA**L**

1.1 SUMMARY

A. Section Includes:

1. PVC pipe and fittings.
2. Encasement for piping.
3. Manholes.
4. Concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
B. Protect pipe, pipe fittings, and seals from dirt and damage.
C. Handle manholes in accordance with manufacturer's written rigging instructions.

1.4 QUALITY ASSURANCE

A. Provide materials bearing label, stamp, or other markings of specified testing agency.

1.5 FIELD CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify Architect and Construction Manager no fewer than seven (7) days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

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. Charlotte Pipe and Foundry Company
2. J-M Manufacturing Company, Inc.
3. North American Pipe Company
4. Harrington Corporation (HARCO)

B. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.
C. Piping materials to bear label, stamp, or other markings of specified testing agency.
D. PVC Type PSM Gravity Sewer Piping:

1. Pipe: ASTM D3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

2.2 MANHOLES

A. Standard Precast Concrete Manholes:

1. Standard: ASTM C478/C478M.
2. Description: Precast, reinforced concrete, of depth indicated, with provision for sealant joints.
3. Diameter: 48 or 60 inches minimum unless otherwise indicated.
4. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
5. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
6. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
7. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
8. Joint Sealant: ASTM C990, bitumen or butyl rubber.
9. Resilient Pipe Connectors: ASTM C923/C923M, cast or fitted into manhole walls, for each pipe connection.
10. Steps: ASTM A615/A615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.
11. Grade Rings: Reinforced-concrete rings, 6- to 12-inch total thickness, with diameter matching manhole frame and cover, and with height as required to

adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Standards: ASTM C913 and ASTM C890.
2. Description: Designed in accordance with ASTM C890 for A-16 designation, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
3. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
4. Joint Sealant: ASTM C990, bitumen or butyl rubber.
5. Resilient Pipe Connectors: ASTM C923/C923M, cast or fitted into manhole walls, for each pipe connection.
6. Steps: ASTM A615/A615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.
7. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended in writing by ring manufacturer.
8. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole-Cover Inserts:

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. Parson Environmental Products
    b. Syneco Systems Incorporated
    c. Knutson Industries

2. Source Limitations: Obtain manhole-cover inserts from single manufacturer.
3. Description; Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.
4. Type: Solid.

2.3 CONCRETE

A. Description: Cast-in-place concrete complying with ACI 318, ACI 350, and the following:

1. Cement: ASTM C150/C150M, Type II.
2. Fine Aggregate: ASTM C33/C33M, sand.

3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Provide 2-inch drop across manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: 4 8 percent.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 INSTALLATION OF PIPING

A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for using lubricants, cements, and other installation requirements.
C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
D. Install gravity-flow, nonpressure, drainage piping in accordance with the following:

1. Install piping pitched down in direction of flow, at minimum slope of 0.5 percent unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes

in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 48-inch minimum cover.
4. Install hub-and-spigot, cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install PVC Type PSM sewer piping in accordance with ASTM D2321 and ASTM F1668.
7. Install PVC Type DWV gravity sewer piping in accordance with ASTM D2321 and ASTM F1668.

E. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping in accordance with the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join PVC Type PSM sewer piping in accordance with ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.
3. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

3.4 INSTALLATION OF MANHOLES

A. General: Install manholes complete with appurtenances and accessories indicated.
B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.
C. Form continuous concrete channels and benches between inlets and outlet.
D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops flush with finished surface elsewhere unless otherwise indicated.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete in accordance with ACI 318.

3.6 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."

B. Connect to grease interceptors specified in Section 221323 "Sanitary Waste Interceptors."

3.7 IDENTIFICATION

A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems in accordance with requirements of Bucks County Water & Sewer Authority (BCWSA) Standard Water & Sewer Specifications.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.

5. Air Tests: Test sanitary sewerage in accordance with requirements of Bucks County Water & Sewer Authority (BCWSA) Standard Water & Sewer Specifications, UNI-B-6, and the following:

    a. Test plastic gravity sewer piping in accordance with ASTM F1417.

6. Manholes: Perform vacuum test in accordance with Bucks County Water & Sewer Authority (BCWSA) Standard Water & Sewer Specifications.

C. Leaks and loss in test pressure constitute defects that must be repaired.
D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.9 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 33 31 15

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SECTION 33 42 00 - STORMWATER CONVEYANCE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Corrugated-PE pipe and fittings.
3. PVC pipe and fittings.
4. Concrete pipe and fittings.
5. Cleanouts.
6. Encasement for piping.
7. Catch basins.
8. Stormwater inlets.
9. Stormwater detention structures.
10. Pipe outlets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials are to bear label, stamp, or other markings of specified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes in accordance with manufacturer's written rigging instructions.
D. Handle stormwater inlets in accordance with manufacturer's written rigging instructions.

1.6 FIELD CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

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. AB & I Foundry; a part of the McWane family of companies
2. Charlotte Pipe and Foundry Company
3. Tyler Pipe; a part of the McWane family of companies

B. Source Limitations: Obtain hub-and-spigot, cast-iron soil pipe and fittings from single manufacturer.
C. Pipe and Fittings:

1. Marked with CISPI collective trademark and NSF certification mark.
2. Class: ASTM A74, Extra Heavy class(es).

D. Gaskets: ASTM C564, rubber.

2.2 CORRUGATED-PE PIPE AND FITTINGS

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. Advanced Drainage Systems (ADS)
2. Lane Enterprises
3. JM Eagle

B. Source Limitations: Obtain corrugated-PE pipe and fittings from single manufacturer.
C. Corrugated-PE Drainage Pipe and Fittings NPS 3 to NPS 10 (DN 80 to DN 250): AASHTO M 252, Type S, with smooth waterway for coupling joints.
D. Corrugated-PE Pipe and Fittings NPS 12 to NPS 60 (DN 300 to DN 1500): AASHTO M 294, Type S, with smooth waterway for coupling joints.

2.3 PVC PIPE AND FITTINGS

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. JM Eagle
2. National Pipe & Plastics; a CRH Company
3. North America Pipe Corporation

B. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.
C. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

D. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

E. Adhesive Primer: ASTM F656.

2.4 CONCRETE PIPE AND FITTINGS

A. Source Limitations: Obtain concrete pipe and fittings from single manufacturer.
B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C76.

1. Bell-and-spigot ends and gasketed joints with ASTM C443, rubber gaskets
2. Class III, Wall A.
3. Class IV, Wall A.

2.5 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.6 CLEANOUTS

A. PVC Cleanouts:

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. IPS Corporation
    b. NDS Inc
    c. Zurn; Zurn Elkay

2. Source Limitations: Obtain PVC cleanouts from single manufacturer.
3. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.7 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48-60 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps; FRP ladder; or ASTM A615/A615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C913; designed in accordance with ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.

2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps; FRP ladder; or ASTM A615/A615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.
6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

2.8 STORMWATER INLETS

A. Inlets:

1. As indicated on Drawings and in accordance with PennDOT Publication 72M.

B. Frames and Grates:As indicated on Drawings and in accordance with PennDOT Publication 72M.

2.9 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

2.10 STORMWATER DISPOSAL SYSTEMS

A. Stormwater Management (SWM) Crate Systems:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ferguson; R-Tank or comparable product by one of the following:

   a. Brentwood StormTank
   b. ACO StormBrixx

2. Source Limitations: Obtain crate system from single manufacturer.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 INSTALLATION OF PIPING

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
F. Install gravity-flow, nonpressure drainage piping in accordance with the following:

1. Install piping pitched down in direction of flow.
2. Install hub-and-spigot, cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
3. Install PE corrugated sewer piping in accordance with ASTM D2321.
4. Install PVC sewer piping in accordance with ASTM D2321 and ASTM F1668.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:

1. Join hub-and-spigot, cast-iron soil piping with gasketed joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
3. Join PVC sewer piping in accordance with ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasketed joints.
4. Join reinforced-concrete sewer piping in accordance with ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
5. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.4 INSTALLATION OF CLEANOUTS

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, as indicated on Drawings . Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 INSTALLATION OF MANHOLES

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops flush with finished surface elsewhere unless otherwise indicated.

3.6 INSTALLATION OF CATCH BASINS

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 INSTALLATION OF STORMWATER INLETS/OUTLETS

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.8 INSTALLATION OF STORMWATER DISPOSAL SYSTEMS

A. Stormwater Management (SWM) Crate Systems: Excavate trenches of width and depth, and install system and backfill in accordance with stormwater management (SWM) crate system manufacturer's specificatios and written instructions.

3.9 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221414 "Storm Drainage Piping."

3.10 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Leaks and loss in test pressure constitute defects that must be repaired.
C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 33 42 00

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SECTION 33 42 00.01 - STORMWATER CONVEYANCE FOR INFRASTRUCTURE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts.

B. Related Requirements:

1. Section 31 05 13 "Soils for Earthwork" for soils for backfill in trenches.
2. Section 31 05 16 "Aggregates for Earthwork" for aggregate for backfill in trenches.
3. Section 31 05 19.13 "Geotextiles for Earthwork" for geotextile filter fabric.
4. Section 31 23 16 "Excavation" for product and execution requirements for excavation and backfill as required by this Section.
5. Section 31 23 16.13 "Trenching" for execution requirements for trenching as required by this Section.
6. Section 31 23 23 "Fill" for requirements for backfill to be placed under this Section.
7. Section 33 05 61 "Concrete Manholes" for manholes and accessories as required by this Section.
8. Section 33 42 00 "Stormwater Conveyance" for PVC cleanouts.

1.2 COORDINATION

A. Coordinate Work of this Section with termination of storm sewer connection outside building, trenching, connection to site stormwater conveyance system.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Cleanouts.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
B. Store materials according to manufacturer instructions.
C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

2.2 CLEANOUTS

A. Cleanout Lids and Frames:

1. Basis-of-Design Product: Provide Neenah Foundry; Model R-1976 and relevant technical details including physical, functional, or performance characteristics of the named product that an "equal" item must meet to be deemed acceptable from one of the following:

    a. IPS Corporation
    b. IPS Corporation
    c. Zurn Industries, LLC

2. Materials: Cast iron.
3. Lid:

    a. Hinged.
    b. Design: As indicated on Drawings.

4. Nominal Lid and Frame Size: As indicated on Drawings.

2.3 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. Description: PennDOT Class A concrete.

2.4 MATERIALS

A. Bedding and Cover:

1. Bedding: Fill Type , as specified in Section Section 31 23 23 "Fill".
2. Cover: Fill Type , as specified in Section Section 31 23 23 "Fill".
3. Soil Backfill from above Pipe to Finish Grade: Soil Type as specified in Section

Section 31 23 23 "Fill".

4. Subsoil: No rocks more than 3 inches in diameter, frozen earth, or foreign matter.

2.5 FINISHES

A. Steel Galvanizing:

1. Comply with ASTM A123/A123M.
2. Hot-dip galvanized after fabrication.

B. Galvanizing for Nuts, Bolts, and Washers: Comply with ASTM A153/A153M.

2.6 ACCESSORIES

A. Geotextile Filter Fabric:

1. As specified in Section 31 05 19.13 "Geotextiles for Earthwork."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Owner's Geotechnical Consultant present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Verify that trench cut and excavation base is ready to receive Work of this Section.
C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
B. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION OF STORM DRAINAGE PIPING

A. Excavation and Bedding:

1. Excavate trench to 6 inches below pipe invert, and as specified in Section 312316.13 "Trenching."
2. Hand trim excavation for accurate placement of piping to indicated elevations.
3. Place bedding material at trench bottom.

4. Level materials in continuous layers not exceeding 8-inch compacted depth.
5. Maintain optimum moisture content of bedding material to attain required compaction density.
6. Level fill materials in continuous layers not exceeding 8 inches in depth, and compact to 95 percent maximum density.

B. Piping:

1. Pipe, Fittings, and Accessories: Comply with ASTM D2321.
2. Seal joints watertight.
3. Cradle bottom 20 percent of pipe diameter to avoid point load.
4. Install aggregate at sides and over top of pipe.
5. Install top cover to minimum compacted thickness of 12 inches and compact to 95 percent maximum density.
6. Backfilling and Compaction:

    a. As specified in Section 31 23 23 "Fill".
    b. Do not displace or damage pipe while compacting.

7. Manholes: As specified in Section 33 05 61 "Concrete Manholes."
8. Pipe Markers: As specified in Section 33 05 97 "Identification and Signage for Utilities."
9. Install Site storm drainage system piping to within five (5) feet of building.

3.4 INSTALLATION OF CATCH BASINS AND CLEANOUTS

A. Catch Basins and Cleanouts:

1. Form bottom of excavation clean and smooth, and to indicated elevation.
2. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.
3. Level top surface of base pad.
4. Sleeve concrete shaft sections to receive storm sewer pipe sections.
5. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
6. Mount lid and frame level in grout, secured to top section to indicated elevation.

3.5 TOLERANCES

A. Maximum Variation from Indicated Pipe Slope: 1/8 inch in 10 feet.

3.6 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 42 00.01

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SECTION 33 42 13 - STORMWATER CULVERTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe culvert.

B. Related Requirements:

1. Section 310516 "Aggregates for Earthwork" for aggregate for backfill in trenches.
2. Section 310519.13 "Geotextiles for Earthwork" for geotextile fabric for subdrainage.
3. Section 312316 "Excavation" for excavating for culvert piping.
4. Section 312316.13 "Trenching" for excavating and backfilling for culvert piping.
5. Section 312323 "Fill" for backfilling.
6. Section 313716.13 "Rubble-Stone Riprap" for fill at pipe ends.

1.2 COORDINATION

A. Coordinate Work of this Section with termination of storm sewer, trenching, connection to site stormwater conveyance system.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Pipe culvert.
2. Concrete encasement and cradles.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports: For pipe culvert, pile support systems, and concrete encasement and cradles.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
B. Storage:

1. Store materials according to manufacturer instructions.

2. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
3. Do not store pipe flat on ground.
4. Store UV-sensitive materials out of direct sunlight.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Cradle pipe to prevent point stress.
4. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Perform Work according to:

1. The State of Pennsylvania Department of Transportation standards.

2.2 PIPE CULVERT

A. Reinforced Circular Concrete Pipe:

1. Manufacturers:

a. Oldcastle Infrastructure
b. Monarch Precast Concrete
c. Terre Hill Concrete Products

2. Comply with AASHTO M170 and PennDOT Publication 280, Class III and Wall Type B.
3. Reinforcement: Mesh.
4. Shape:

a. Circular with nominal diameter as indicated on Drawings.

5. End Joints: Bell and spigot.

B. Perforated PE Culvert Pipe:

1. Manufacturers:

a. Contech Engineered Solutions LLC
b. ADS
c. Lane Enterprises, LLC

2. Comply with AASHTO M252 and M294.
3. Interior: Smooth lined.
4. Joints:

    a. Comply with AASHTO M294.
    b. Interior: Smooth lined.
    c. PE sleeve with gasket.

2.3 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. Description: PennDOT Class A concrete.

2.4 MATERIALS

A. Bedding and Cover:

1. Bedding: Fill Type , as specified in Section 312316.13 "Trenching".
2. Cover: Fill Type , as specified in Section 312316.13 "Trenching".

2.5 MIXES

A. Fill at Pipe Ends:

1. Riprap as specified in Section 313716.13 "Rubble-Stone Riprap."

2.6 FINISHES

A. Steel:

1. Galvanizing:

    a. Comply with ASTM A123/A123M.
    b. Hot-dip galvanize after fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions , with Owner's Geotechnical Consultant present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Verify that trench cut and excavation base is ready to receive Work of this Section.
C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
B. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION OF PIPE CULVERT

A. Excavation and Bedding:

1. Excavate culvert trench to depth below pipe invert, and as specified in Section 312316.13 "Trenching."
2. Hand trim excavation for accurate placement of piping to indicated elevations.
3. Place bedding material at trench bottom.
4. Maintain optimum moisture content of bedding material to attain required compaction density.
5. Level fill materials in continuous layers not exceeding 8 inches in depth, and compact to 95 percent maximum density.
6. Install pipe on compacted subgrade meeting bedding requirements.

B. Culvert:

1. Positioning:

    a. Lift or roll culvert into position; do not drop or drag culvert over prepared bedding.
    b. Shore culvert to required position, and retain in place until after compaction of adjacent fills.
    c. Ensure that pipe remains in correct position and to required slope.

2. Repair surface damage to pipe protective coating with two coats of compatible bituminous paint coating.
3. Backfilling and Compaction:

    a. As specified in Section 312323 "Fill".
    b. Level fill materials in continuous layers not exceeding 8 inches in depth, and compact to 95 percent maximum density.
    c. Do not displace or damage pipe while compacting.
    d. Install cover at sides and over top of pipe.
    e. Install cover to minimum compacted thickness of 8 inches and compact to 95 percent maximum density.
    f. Maintain optimum moisture content of bedding material to attain required compaction density.

4. Install culvert end gratings.

C. Pipe Ends:

1. Place fill at pipe ends as indicated on Drawings.
2. Level fill materials in continuous layers not exceeding 8 inches in depth, and compact to 95 percent maximum density.

3.4 TOLERANCES

A. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.
B. Maximum Variation from Intended Elevation of Culvert Invert: 1/2 inch.
C. Maximum Offset of Pipe from Indicated Alignment: 1 inch.
D. Maximum Variation in Profile of Structure from Intended Position: 1.0 percent.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Inspection: Request inspection from Owner's Geotechnincal Consultant prior to and immediately after placing aggregate cover over pipe.
C. Compaction Testing:

1. Comply with ASTM D698 or ASTM D6938.
2. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
3. Testing Frequency: One test at each structure and one test for each 150 lineal feet of pipe or fractions thereof per foot of backfill.

3.6 PROTECTION

A. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 42 13

SECTION 33 47 13 - POND AND RESERVOIR LINERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes geomembrane liners for stormwater basins, ponds and reservoirs fabricated from the following:

1. High-density polyethylene (HDPE).

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavating, compacting, and grading the subgrade; for excavating and backfilling the anchor trench; for protecting the earthwork; for removing ground water from subgrade to the extent required by liner manufacturer; for adding requirements for the earth cover; and for the filter fabric and other geotextiles.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and accessories for geomembrane liners.

B. Shop Drawings: Include panel layout, seams, penetrations, perimeter anchorage, and methods of attachment and sealing to other construction. Differentiate between factory and field seams and joints.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of geomembrane liner.
B. Product Test Reports: For each geomembrane sheet, for tests performed by a qualified testing agency.
C. Source quality-control reports.
D. Field quality-control reports.
E. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For geomembrane liner to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace geomembrane liner that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Leaks in geomembrane liner.
   b. Defects in seams.
2. Warranty Period: 10 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain geomembrane liner, accessories, and required seaming materials, solvents, and adhesives from single source.

2.2 PERFORMANCE REQUIREMENTS

A. Provide geomembrane liners that prevent the passage of water.

2.3 HDPE SHEET MATERIALS

A. HDPE Sheet: Formulated from virgin PE, compounded for use in hydraulic structures, and formed into uniform sheets with material properties complying with GRI Test Method GM13 for thickness indicated.

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. Agru America, Inc
   b. Layfield Environmental Containment; Layfield Group Limited
   c. Solmax (GSE Environmental)
   d. EPI (Environmental Protection, Inc.)
   e. Pro Fabric Supply

2. Minimum Average Sheet Thickness: 40 mils per ASTM D5199.
3. Sheet Texture: One side smooth; other side textured.

2.4 FABRICATION

A. Fabricate geomembrane liner panels from sheets in sizes as large as possible with factory-sealed seams, consistent with limitations of weight and installation procedures. Minimize field seaming.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for soil compaction and grading; for subgrade free from angular rocks, rubble, roots, vegetation, debris, voids, protrusions, and ground water; and for other conditions affecting performance of geomembrane liner.
B. Examine anchor trench excavation, where geomembrane liner will be secured, for substrate conditions indicated above and for correct location and configuration.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary ballast, until edges are permanently secured, that does not damage geomembrane liner or substrate, to prevent uplift of geomembrane liner in areas with prevailing winds.
B. Prepare surfaces of construction penetrating through geomembrane liner according to geomembrane liner manufacturer's written instructions.

3.3 INSTALLATION

A. General: Place geomembrane liner over prepared surfaces to ensure minimum handling. Install according to Shop Drawings and in compliance with geomembrane liner manufacturer's written instructions. Begin placing geomembrane liner at Project's upwind direction and proceed downwind. Install geomembrane liner in a relaxed condition, free from stress and with minimum wrinkles, and in full contact with subgrade. Do not bridge over voids or low areas in the subgrade. Fit closely and seal around inlets, outlets, and other projections through geomembrane liner. Permanently secure edges.
B. Field Seams: Comply with geomembrane liner manufacturer's written instructions. Form seams by lapping edges of panels 2 to 4 inches, unless instructions require a larger overlap. Wipe contact surfaces clean and free of dirt, dust, moisture, and other foreign materials. Use solvent-cleaning methods and grind geomembrane seam surfaces if recommended by geomembrane liner manufacturer. Proceed with seaming at required temperatures for materials and ambient conditions. Continuously bond sheet to sheet to construct single or double seams of width recommended for method of seaming used. Seal or fuse free seam edges. Inspect seams and reseal voids.

1. Adhesive Bonding: Apply bonding cement to both contact surfaces in seam area and press together immediately, or use other seaming methods as instructed by geomembrane liner manufacturer. Roll to press surfaces together, to distribute adhesive to leading edges of panels, and to remove wrinkles and fishmouths. Remove excess adhesive.
2. Thermal Bonding: Use thermal-welding technique recommended by geomembrane liner manufacturer. Apply pressure to smoothly bond surfaces together. Examine for and patch wrinkles and fishmouths.

C. Installation in Anchor Trench: Install geomembrane liner in trench according to manufacturer's written instructions. Backfill and compact to lock liner into trench.
D. Attachment to Concrete: Use manufacturer's standard system to suit Project conditions. Support adhesive and geomembrane on minimum 8-inch- wide concrete substrate unless otherwise indicated.

1. Install batten strips over geomembrane liner as indicated on Drawings.

E. Liner Repairs: Repair tears, punctures, and other imperfections in geomembrane liner field and seams using patches of geomembrane liner material, liner-to-liner bonding materials, and bonding methods according to geomembrane liner manufacturer's written instructions. Apply bonding solvent or weld to contact surfaces of both patch and geomembrane liner, and press together immediately. Roll to remove wrinkles.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Nondestructive Testing: Visually inspect seams and patches. Comply with ASTM D4437 for Air Lance Test, Vacuum Box Testing, or Ultrasonic (High Frequency) Pulse Echo Testing or with GRI Test Method GM6, as applicable to geomembrane liner and seam construction. Record locations of failed seams and patches. Individually number and date occurrences and details of leak and remedial action. Repair leaking seams and patches.
C. Prepare test and inspection reports.

3.5 PROTECTION

A. Protect installed geomembrane liner according to manufacturer's written instructions. Repair or replace areas of geomembrane liner damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.
B. Before initial filling of pond or placement of earth cover, inspect seams and patched areas to ensure tight, continuously bonded installation. Repair damaged geomembrane liner and seams and reinspect repaired work.

END OF SECTION 33 47 13

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