

**CONTRACT DOCUMENTS & SPECIFICATIONS
FOR
CONTRACT NO. eDPW-121422-2**

Sprinkler Piping & Fire Pump Modifications at Government Center Complex

November 3, 2022

Prepared for:

The County of Delaware
Department of Public Works
Government Center Building
201 West Front Street
Media, PA 19063

Prepared by:

Gillan & Hartmann, Inc.
140 Whitaker Avenue
Mont Clare, PA 19453



Delaware County Council:

Dr. Monica Taylor, Chair
Elaine Paul Schaefer, Vice Chair
Kevin M. Madden
Christine A. Reuther
Richard R. Womack Jr.

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Advertisement

Sealed bids will be received through PennBid™ by Delaware County for The SPRINKLER, PIPING, & FIRE PUMP MODIFICATIONS AT GOVERNMENT CENTER COMPLEX, until 11:00 AM, prevailing time, on December 14, 2022.

All documents and solicitations details are available online anytime at no cost at PennBid™ (<https://pennbid.procureware.com>). Note, PennBID™ assesses a fee to the bidder who is issued the award. Click on the “Solicitations” and “View” tabs.

Each bid must be accompanied by a certified check or bid bond payable to the Owner in an amount of not less than ten percent (10%) of the bid or bids. Only bonds from companies licensed to do business in the State where the Owner is located will be accepted and the bond shall so state same.

This project involves replacement of sprinkler piping systems and equipment, fire pumps, electrical power generators, related electrical power, related fire alarm, new plumbing domestic water and sanitary systems, new HVAC systems, and new electrical systems. Five Prime Construction Contracts: General Construction, Mechanical, Plumbing, Electrical, and Fire Suppression Work.

Bids must be submitted unconditionally. No bidder may withdraw bid within SIXTY (60) days after the scheduled closing time for receipt of bids.

The Owner reserves the right to waive any informalities, or to reject any or all bids.

CONTRACT eDPW-121422-2

Invitations for Bids for
**SPRINKLER, PIPING, AND FIRE PUMP MODIFICATIONS AT
GOVERNMENT CENTER COMPLEX**

The undersigned Delaware County Council will receive sealed bids electronically through PennBid™ until **11:00 AM, on December 14, 2022**, for the Government Center Complex.

Failure to accompany this bid with an appropriate bid security noted above will automatically disqualify the bidder.

The contractor shall list related experience with appropriate references and complete the attached AIA Document A305 and submit with bid. In addition, the bidder shall submit with his bid a written statement describing his Apprentice Training Program and Affirmative Action Program. **In accordance with the County of Delaware Ordinance No 2022-7.**

All documents and solicitation details are available and open to public inspection at PennBid™ (<https://pennbid.procureware.com>). Click on the “Solicitations” and “View” tabs. The bidder who is awarded the contract will be required to pay a fee to PennBid™. The names of those who have secured plans/specifications may be obtained at PennBid™.

This project involves replacement of sprinkler piping systems and equipment, fire pumps, electrical power generators, related electrical power, related fire alarm, new plumbing domestic water and sanitary systems, new HVAC systems, and new electrical systems. Five Prime Construction Contracts: General Construction, Mechanical, Plumbing, Electrical, and Fire Suppression Work.

All workmen performing work on this project shall be paid the general minimum **Prevailing Wage Rates** supplied herein, as determined by the Secretary of the Pennsylvania Department of Labor and Industry, in accordance with the Regulations for Pennsylvania Prevailing Wage Act.

There will be an on-site Pre-Bid Conference, 11:00 AM on November 22, 2022 at the Government Center Complex. This conference is not mandatory but is highly encouraged.

Questions may be asked through the PennBID system. The final date to submit questions is 2:00pm November 29, 2022.

If you are a person with a disability and wish to attend the bid opening, and require an auxiliary aid, service or accommodation to observe or participate in

the bid opening proceedings, please contact Delaware County Department of Public Works to discuss how your needs can best be accommodated.

The Delaware County Council reserves the right to reject any and all bids or parts thereof and to determine whether the quality and type of equipment and/or service to be furnished meet the requirements for which it is intended. They further reserve the right to insist or waive any technicalities required for the best interest of the County and to consider competency and responsibility of the bidder before the award of the Contract and award bids accordingly.

Delaware County Council:

Dr. Monica Taylor, Chair
Elaine Paul Schaefer, Vice Chair
Kevin M. Madden
Christine A. Reuther
Richard R. Womack
Delaware County Council

Government Center Complex

Name and Address of Bidder

Phone Number

Terms (if offered, list here):

INSTRUCTIONS TO BIDDERS

1. **PROJECT SCOPE**

The complete description of the work required to complete this project is contained in the General Conditions, Standard Specifications, Special Provisions and Construction Plans.

PLEASE NOTE: Contractor must develop and submit their own COVID-19 Work Safety Plan, and have their plan approved by Delaware County, prior to any work starting. Contractor will be responsible for any/all additional Personal Protective Equipment (PPE), which their employees require, in accordance with PennDOT Publication 408, Section 107.08. The contractor is also required and expected to adhere to their own COVID-19 Safety Plan while working on-site. Violations to the approved COVID-19 Safety Plan can result in project delays or shut-downs. The project shall not restart until Delaware County approves the re-start of work.

2. **TIME FOR COMPLETING WORK**

The work under this contract must be completed WITHIN 456 DAYS consecutive calendar days from the date of the Official Notice-to-Proceed. This work must be completed in the summer to avoid increase in school traffic along the detour. All Bidders are notified that time is of the essence of this Contract. The successful Bidder will be required to so execute the work to ensure its completion within the above number of calendar days set forth.

3. **BID INFORMATION**

The Owner may consider non-responsive any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities in or reject any and all bids. A bid which is incomplete, obscure, conditioned, or which contains additions not called for, or irregularities of any kind, including alterations or erasures, may be rejected. Any bid received after the time and date specified shall not be considered.

In the event that there is a tie between two or more lowest responsible bidders, and the place of business of one is located in Delaware County and the other(s)

Section B
Instructions to Bidders

is (are) located outside of the County, the Council may in their discretion opt to award the bid to the Delaware County bidder, all other relevant factors being equal.

Requests for Information are required to be submitted in writing seven (7) calendar days prior to bid opening to:

CENTRAL PURCHASING
[HTTPS:PENNBID.PROCURWARE.COM/CLARIFICATIONS](https://PENNBID.PROCURWARE.COM/CLARIFICATIONS)

No bid may be withdrawn within the twenty-four (24) hours prior to the bid opening.

The Contractor shall not transfer or sublet any portion of the work covered by these bid documents without written consent of the County.

4. BID SUBMITTAL FORMS

The Bid Submittal Forms consist of the following:

- Invitation to Bid
- Proposal Form for Unit Price Contract
- Bid Guarantee
- Consent / Agreement of Surety
- Non-Collusion Affidavit
- Contractor Responsibility Certification Form
- AIA Document A305 - 1986, Contractor's Qualification Statement
- Financial Statement in accordance with A305 – 1986, Section 5.1.1
- Apprenticeship Training Program (Special Conditions No. 21)
- Affirmative Action Program (Special Conditions No. 22)

5. PREPARATION OF BIDS

Bidders will be assumed to have carefully examined **the Invitation for Bids, the Instructions to Bidders, the Form of Proposal, the Agreement, the General Conditions, Other Conditions of the Contract, the Standard Specifications, Special Provisions and the Construction Drawings for the work**, all attached hereto, and to have carefully investigated physical conditions at the site and character of the work to be done and to have inquired fully into the difficulties of construction of the work before preparing their Proposal. The Owner will not be responsible for failure of the Contractor to properly estimate such difficulties and costs, or for overlooking any of the requirements of the Contract Documents.

If, in the Bidder's opinion, any work is specified in such a manner as would make it impossible for him to guarantee to produce the required result; or should obvious and unintentional errors or omissions appear in Contract Documents, the Bidder shall refer the same in writing to the Engineer for a decision before submitting his bid. If the Bidder fails to make such reference, no extra charge thereafter will be allowed or excuse entertained for failure to carry out the work in an acceptable manner, or to produce the required results, or to remedy defects in the workmanship because of alleged impossibilities in the production of the results specified or because of inadequate or improper Specifications.

No oral interpretations of the meaning of the Contract Documents made to any prospective Bidder by any person will be binding upon the Owner to any extent or for any purpose and may not be relied upon by any prospective Bidder.

Every request for such interpretation should be in writing, addressed to:

CENTRAL PURCHASING
[HTTPS:PENNBID.PROCURWARE.COM/CLARIFICATIONS](https://pennbid.procurement.com/clarifications)

To be given consideration, each request must be received at least seven (7) calendar days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be given in the form of written Addenda to the Bid Documents which will be mailed by Certified Mail to

Section B
Instructions to Bidders

all prospective Bidders (at the respective address furnished for such purposes) not later than three (3) calendar days prior to the date fixed for the opening of bids. Failure of any Bidder to receive any such Addenda or interpretations shall not relieve said Bidder from obligations with respect to the bid as submitted. All addenda so issued shall become part of the Contract Documents

6. CONDITIONS OF WORK

Each Bidder must inform himself fully of the conditions relating to the construction and labor under which the work will be performed; failure to do so will not relieve the successful Bidder of his obligation to furnish all material and labor necessary to carry out provisions of the Contract Documents and to complete the contemplated work for the consideration set forth in his bid.

Bidders are notified that it is obligatory upon them to obtain by their own means, information which they may require as to the existing physical conditions and, in particular, as to subsurface and groundwater conditions. Bids for all types of excavation are to be based on Unclassified Excavation which shall include all types of materials which are encountered, including, but not limited to weathered, decomposed, and sound bedrock; soil, gravel, and boulders; debris of any kind and organic matter.

7. ESTIMATED QUANTITIES

The quantities given in the Form of Proposal and attached to the Contract Documents are approximate only, being given as a basis for the uniform comparison of bids, and the Owner does not expressly or by implication warrant that the actual amount of work will correspond therewith.

8. CONTAMINATED SOILS

Should the Engineer agree that reasons exist to believe that contaminated soil is encountered in the excavation, the Owner shall, at his cost, engage the services of an environmental services company to assess the extent, if any, of the contamination of soils. If contamination is found to be present, the contaminated soils shall be separately stockpiled on and covered by plastic sheeting at the site for disposal by the Contractor.

PROPOSAL

Contract No. eDPW-121422-2

Date: _____

Council Members:

The undersigned hereby submits a proposal for Sprinkler, Piping & Fire Pump Modifications at Government Center Complex, located 201 West Front Street, Media, PA, Delaware County, Pennsylvania, at the following price:

TOTAL BASE BID

_____ Dollars \$ _____

(The unit prices supplied above are required to be indicated in both words and figures. In the event of a discrepancy between the words and figures for a given item, the price shown in words will be accepted.)

- All items must be bid.
- A performance bond and a labor and materials bond in the amount of one hundred percent (100%) of the total amount bid, and a maintenance bond must be submitted by the successful bidder within ten (10) days from the bid award date.

IF AND WHERE DIRECTED BID

[illegible]

IF AND WHERE DIRECTED BID

Dollars \$

It is understood that THE INSURANCE REQUIREMENTS ARE A CRITICAL PORTION OF THIS BID. THE REQUIREMENTS **AS SET FORTH IN VARIOUS SECTIONS** MUST BE SATISFIED. IT IS UNDERSTOOD THAT NO EXCEPTIONS WILL BE MADE.

It is further understood that upon notice to furnish the County with the necessary Contract and Bonds, we will execute the attached Form of Contract and Bonds with the County of Delaware within twenty (20) calendar days after receipt of such notice.

It is understood and agreed that the County Council reserves the right to reject any and all bids and that if the Successful Bidder fails to execute the attached Contract and Bond within twenty (20) calendar days after receiving notice from the County to do so, the County Council shall be free to notify the next lowest, responsible bidder. It is understood that if the Successful Bidder shall fail to execute a Contract as set forth in these General Condition, the deposit will be forfeited as liquidated damages. Award will be based on bids for the Base Bid(s) or a combination of Base Bid(s) and if and where directed.

It is understood that this Bid may not be withdrawn for a period of sixty (60) calendar days after the date of opening thereof.

It is understood that we will start work within **seven (7)** calendar days after execution of the Contract and shall complete work in accordance with the schedule given in Section B, Instructions to Bidders, Time for Completing Work. Liquidated Damages (if any) shall be assessed as defined in the Special Conditions, Liquid Damages, for all days past this limit. It is understood that the County may, on its own decision or initiate, extend the completion date by giving notice of all parties to this Contract of its intention to extend.

Delaware County shall not be liable for any expenses, damages, or loss of profits, anticipated or otherwise.

It is understood that if our Bonding Company is not a Pennsylvania Company, the Bid Bond, Performance Bond and Payment Bond, must be countersigned by a Pennsylvania Resident Agent, with Power of Attorney so to do.

The undersigned acknowledges receipt of the foregoing Addenda and that he has prepared this bid accordingly.

Addendum No.	Date
_____	_____
_____	_____
_____	_____

Insert the numbers of all addenda received - If none were received, insert the word "None"

It is understood that each bidder is to prepare and present satisfactory evidence of his experience, qualifications, and financial abilities to carry out the terms of the Contract. In addition, the Prime Contractor shall prepare and present satisfactory evidence of his qualification and references related to the work.

Material Safety Data Sheets (MSDS) must be submitted for respective products before award, in compliance with the Federal Hazard Communication Standard Act (29 CFR 1910, 1200) and various State Right-to-Know laws, as applicable.

Our signature on this proposal page signifies that we have read and agree to comply with all parts of the Invitation, Instructions, Proposal, General Conditions, Special Conditions and Specifications of this Bid and will carry out all the conditions of the above.

The undersigned hereby certifies that this bid is genuine, and not a sham or collusive, or made in the interest or in behalf of any person, firm, or corporation not herein named; that the undersigned has not directly or indirectly induced or solicited any bidder to refrain from bidding, and that the undersigned has not, in any manner, sought by collusion to secure for himself an advantage over any other bidder.

It is understood that the Proposal Page must have two (2) signatures, and if the firm is a corporation, the corporate seal must also be affixed when submitting bid.

Respectfully submitted,

FIRM NAME _____

SIGNATURE _____

TYPED NAME & TITLE _____

OFFICIAL ADDRESS _____

Telephone # _____ FAX # _____

ATTEST: _____

Secretary or Assistant Secretary

Bidder will check whether the bid is by:
an individual (), partnership (), or corporation ().

NOTES:

If the Bidder is a partnership, the names of all members of the firm, as well as the trading name, shall be set forth. If the Bidder is a corporation, the Bid must be executed by the President or Vice-President, and attested by the Secretary or Assistant Secretary of the corporation, with the corporate seal applied. No other names will be accepted unless accompanied by the proper certification from the corporation permitting other than the President or Vice-President and Secretary to sign contracts. If the business is operated by a sole owner, only his signature is required, and it should be noted under signature that he is the sole owner.

COUNTY OF DELAWARE

VENDOR/CONTRACTOR'S INSURANCE REQUIREMENTS

COMPREHENSIVE GENERAL LIABILITY

Before the Contract is awarded, the Contractor shall take out and maintain during the life of this Contract such Public Liability and Property Damage insurance as shall protect him and any sub-contractors, if any, performing work covered by this Contract, from all claims for loss arising from Property damage, personal injury and bodily injury including accidental death. Such Insurance Policy shall include Products and Completed Operations coverage and include coverage for damages that may arise from the Operations of the Contractor or by any sub-contractor or by anyone directly or indirectly employed by either of them. The Combined Single Limit of Liability required is \$3,000,000 per occurrence with a deductible of no more than \$1,000.

VEHICLES

Comprehensive Business Automobile Coverage shall be maintained with a Combined Single Limit of Liability in an amount no less than \$1,000,000 per occurrence with no deductible.

CATASTROPHE UMBRELLA LIABILITY

One million dollars in excess of Primary General.

WORKER'S COMPENSATION

Worker's Compensation Insurance required by Pennsylvania law covering all Owner's employees and all employees of the general contractors and all sub-contractors. A current certificate of Exempt status from the Pennsylvania Department of Labor and Industry is acceptable if the Owner is an Exempt Self-Insurer in the State of Pennsylvania.

EMPLOYER'S LIABILITY INSURANCE:

Employer's Liability Insurance with limits no less than \$500,000 per accident or employee disease.

The County of Delaware shall be named as an additional insured on all policies insofar as the specified Contract is concerned. In addition, the Contractor shall furnish the County with a certificate of insurance showing the type, amount, class of operations covered, effective dates and dates of expiration. All policies should also contain a sixty (60) day notice of cancellation clause.

NOTE:

Section D
Insurance Requirements

If the owner maintains a self-insurance program or a limited self-insurance program for any or all of the exposures listed above, a complete description of the program with information on excess carriers and funding arrangements should be provided. In the event that the worker's compensation is self-insured, a copy of the current exemption shall be provided.

BID GUARANTEE

KNOW ALL MEN BY THESE PRESENTS, THAT WE, the undersigned,
_____, as Principal,
and held firmly bound unto _____ as
OWNER in the penal sum of _____
for the payment of which, well and truly to be made, we hereby jointly and
severally bind ourselves, successors, and assigns.

Signed, this _____ day of _____, 20 ____.

The Condition of the above obligation is such that whereas the Principal has
submitted to The Delaware County Council a certain BID, attached hereto and
hereby made a part hereof to enter into a contract in writing, for Sprinkler, Piping
& Fire Pump Modifications at Government Center Complex located 201 West
Front Street, Media, PA, Delaware County, Pennsylvania.

NOW, THEREFORE,

- (a) If said BID shall be rejected, or
- (b) If said BID shall be accepted and the Principal shall execute and
deliver a contract in the Form of Contract attached hereto (properly
completed in accordance with said BID) and shall furnish a BOND
for his faithful performance of said contract, and for the payment of
all persons performing labor or furnishing materials in connection

Section E
Bid Guarantee

therewith and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation stated.

The Surety, for value received, hereby stipulates, and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of the time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

Principal

Surety

By: _____

Section F
Consent/Agreement of Surety

CONSENT/AGREEMENT OF SURETY

The undersigned _____
Name of Surety Company
a corporation organized and existing under the laws of
_____ and authorized to do business
in the Commonwealth of Pennsylvania do hereby consent and agree with
The County of Delaware that if the proposal of
_____, for the project
Name of Bidder

Sprinkler, Piping & Fire Pump Modifications at Government Center Complex
201 West Front Street
Media, PA

be accepted and a contract for said work be awarded to said bidder, it will, upon
its being so awarded, become the surety for said Bidder on such surety bonds as
are called for in the Bid Documents.

Signed and Sealed (Date)

Name of Surety Company

By: _____
Attorney-in-fact

INSTRUCTIONS FOR NON-COLLUSION AFFIDAVIT

1. This Non-Collusion Affidavit is material to any contract awarded pursuant to this bid. According to the Pennsylvania Antibid-Rigging Act, 73 P.S. 1611 et seq., governmental agencies may require Non-Collusion Affidavits to be submitted together with bids.
2. This Non-Collusion Affidavit must be executed by the member, officer or employee of the bidder who makes the final decision on prices and the amount quoted in the bid.
3. Bid rigging and other efforts to restrain competition, and the making of false sworn statements in connection with the submission of bids are unlawful and may be subject to criminal prosecution. The person who signs the Affidavit should examine it carefully before signing and assure himself or herself that each statement is true and accurate, making diligent inquiry, as necessary, of all other persons employed by or associated with the bidder with responsibilities for the preparation, approval or submission of this bid.
4. In the case of a bid submitted by a joint venture, each party to the venture must be identified in the bid documents, and an Affidavit must be submitted separately on behalf of each party.
5. The term “complementary bid” as used in the Affidavit has the meaning commonly associated with that term in the bidding process and includes the knowing submission of bids lower than the bid of another firm, any intentionally low or noncompetitive bid, and any other form of bid submitted for the purpose of giving a false appearance of competition.
6. Failure to file an Affidavit in compliance with these instructions may result in disqualification of the bid.

NON-COLLUSION AFFIDAVIT

State of _____: Contract/Bid No. _____

County of _____:

I state that I am _____ of _____
Title Name of Firm

and that I am authorized to make this affidavit on behalf of my firm and its owners, directors, and officers. I am the person responsible in my firm for the price(s) and the amount of this bid.

I state that:

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

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

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

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

(5) _____, its affiliates,
Name of my firm

Subsidiaries, officers, directors and employees are not currently under investigation by any governmental agency and have not in the last four years been convicted or found liable for any act prohibited by the State or Federal law

Section H
Non-Collusion Affidavit

in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract, except as follows:

I _____ state that _____
Name of firm

understands and acknowledges that the representations are material and important and will be relied on by Delaware County 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 Delaware County of the true facts relating to the submission of bids for this contract.

Name

Company Position

SWORN TO AND SUBSCRIBED
BEFORE ME THIS ____ DAY
OF _____, 20____

Notary Public

My Commission Expires: _____

COUNTY OF DELAWARE PENNSYLVANIA

ORDINANCE No. 2021-2

AN ORDINANCE OF THE COUNTY OF DELAWARE, COMMONWEALTH OF PENNSYLVANIA AMENDING SECTION 6-12 OF THE ADMINISTRATIVE CODE TO INCLUDE THAT COUNTY COUNCIL MEMBERS ARE PROHIBITED FROM KNOWINGLY DERIVING A FINANCIAL INTEREST FROM COUNTY CONTRACTS AND ADDING CERTAIN OTHER CONFLICT OF INTEREST PROVISIONS.

WHEREAS, pursuant to Section 6-121 of the Administrative Code (the "Code") of the County of Delaware, Commonwealth of Pennsylvania (the "County"), the Code may be amended by ordinances of the County Council; and

WHEREAS, Section 6-12.B(2) of the Code limits elected and appointed officials, the County Executive Director and department heads, and all County employees from having a business interest that would interfere with their official duties; and

WHEREAS, Section 6-12.B(2) includes only a limited restriction of Council members from having a financial interest or other conflict that would interfere with their official duties; and

WHEREAS, County Council believes that a more expansive restriction on financial interests and other conflicts of Council members will allow Delaware County citizens to be assured that Council members will not directly or indirectly knowingly realize any financial gain through their public office other than any compensation that is provided by law;

IT IS HEREBY, ENACTED AND ORDAINED BY County Council of Delaware County, Commonwealth of Pennsylvania as follows:

SECTION 1. The Code shall be amended to add a new Section 6-12.D to read as set forth below:

§ 6-12.D County Council Members Prohibited From Knowingly Deriving a Financial Interest From County Contracts.

(1) Prohibition Against Knowingly Deriving Financial Gain and Conflict of Interest. In addition to the limitations imposed elsewhere in this Administrative Code, including Section 6-12.B(2), no Council member shall knowingly have a financial interest (including any immediate family member having a financial interest) in any entity that is a party to a contract with the County, approved by County Council, including subcontractors.

Notwithstanding the foregoing, there shall be no violation of this Section 6-12.D(1) if a Council member recuses her or himself from voting on a contract in which such Council member (or an immediate family member) has a minor financial interest and submits a written statement listing the reasons for such recusal. Said statement shall be submitted by the Council member to the County Clerk, Council Chairman and Vice Chairman within seven (7) days of identification of the conflict by the member but not less than one (1) day prior to the Council meeting at which a vote on the contract is scheduled. Such statement shall be read into the Council minutes at such meeting.

(2). Other Prohibitions.

- (a) Council members are prohibited from receiving compensation (other than the payment of expenses) as an officer or director of (i) any entity that is a party to a contract with the County and/or (ii) any subcontractor to such an entity.
- (b) Council members are prohibited from using non-public information received through public office for their own financial benefit or the financial benefit of an immediate family member.

- (3). Conflicts of Interest. A Council member must recuse her or himself from voting on a contract if he or she knows that there is a conflict of interest (which is not a financial interest) and shall submit a written statement listing the reasons for such recusal. Such conflicts of interest shall include serving as an officer or director of a nonprofit organization that is a party to a contract with the County and/or any subcontractor to such a contract.

Said statement shall be submitted by the Council member to the County Clerk, Council Chairman and Vice Chairman within seven (7) days of identification of the conflict by the member but not less than one (1) day prior to the Council meeting at which a vote on the contract is scheduled. Such statement shall be read into the Council minutes at such meeting.

(4). Definitions.

A "financial interest" for purposes of this Section 6-12.D is any financial interest in a legal entity engaged in business for profit which comprises more than 5% of the equity of the business or more than 5% of the assets of the economic interest in indebtedness.

An "immediate family member" for purposes of this Section 6-12.D is defined as a parent, spouse, brother and sister (or like relative in laws), child(ren) and step-child(ren).

"Knowingly" or "Knows" means that the individual in question actually knew or, based on facts and circumstances, should have known, of the existence of a financial interest or conflict of interest, as applicable.

A "minor financial interest" for purposes of this Section 6-12.D is any financial interest from which a Council member and all immediate family members, in the aggregate, derives (or reasonably anticipates deriving) compensation, earnings, revenues and/or other payments not exceeding a total of \$25,000 on an annual basis (including the effect of the contract then under consideration for approval by Council).

- (5). Penalties. Any of the following penalties may be imposed for violations of the limitations in Section 6-12.D(1) as determined per Section 6-12.D (5):

- a. A reprimand of the Council member in violation.
- b. A censure of the Council member in violation.
- c. An assessment of a fine of the Council member in violation, in an amount not to exceed the lesser of (i) ten percent (10%) of the total compensation under the contract in question or (ii) \$20,000.

- d. To the extent legally permitted, termination of the contract in question and/or repayment to the County of any profit made by the contractor under such contract.
- e. Any entity, contractor or subcontractor which entered into a contract with the County which resulted in a violation of this section, may be banned as a contractor or subcontractor to the County for a period of two (2) years.

(6). **Determination of Penalties.** The determination of a penalty for the violation of this ordinance shall be made by a majority vote of County Council (not to include the Council member whose action is the subject of such vote) following such investigation and consideration of such evidence as County Council deems appropriate or such other entity or body as may be designated by resolution of County Council.

(7). **County Executive Director.** If the County Executive Director knows that he or she has a financial interest in a contract being considered for approval by County Council, he or she shall disclose such financial interest to County Council prior to approval of such contract by County Council, and such financial interest shall be noted in the minutes of the Council meeting at which such approval is considered. County Council may take appropriate disciplinary action for violation of this requirement by the County Executive Director, subject to the limitations elsewhere in the Administrative Code.

SECTION 2. This Ordinance shall take effect on the tenth day after its adoption.

ENACTED AND ORDAINED by County Council of the County of Delaware, Pennsylvania, this
day of 2021.

COUNTY OF DELAWARE

Brian P. Zidek, Chair

Dr. Monica Taylor, Vice Chair

Kevin M. Madden

Elaine Paul Schaefer

Christine A. Reuther

Attested:

Anne M. Coogan
County Clerk

COUNTY OF DELAWARE PENNSYLVANIA

ORDINANCE No. 2022-7

AN ORDINANCE OF THE COUNTY OF DELAWARE, COMMONWEALTH OF PENNSYLVANIA AMENDING AND RESTATING CHAPTER 29 OF THE COUNTY CODE RELATING TO CONTRACTORS.

WHEREAS, pursuant to § 1-10 of the Code (the "Code") of the County of Delaware, Commonwealth of Pennsylvania (the "County"), the Code may be amended by ordinances of the County Council when passed and adopted in such form as to indicate the intention of the County Council to be a part of the Code; and

WHEREAS, Chapter 29 of the Code sets forth provisions regarding the qualification of contractors for certain County public works projects; and

WHEREAS, County Council has been presented considerations regarding the current public works contract environment and the need for significant changes to its procurement standards for public works construction to address these considerations, limit project delivery risks, protect its financial and proprietary interests, and better ensure efficient procurement and successful delivery of these projects; and

WHEREAS, County Council is committed to addressing the challenges it faces relating to public works projects by enacting necessary and appropriate procurement legislation to protect its proprietary and financial interests and create adequate safeguards to ensure the successful delivery of such projects to the fullest extent possible; and

WHEREAS, Chapter 29 of the Code was last revised in 2007, and County Council desires to update and modernize the provisions of Chapter 29 of the Code;

IT IS HEREBY ENACTED AND ORDAINED BY County Council of Delaware County, Commonwealth of Pennsylvania as follows:

SECTION 1. The Code shall be amended to replace Chapter 29 of the Code in its entirety to read as set forth in Exhibit A attached hereto.

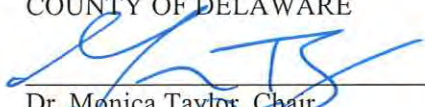
SECTION 2. Any and all other ordinances or parts of ordinances in violation or in conflict with the terms, conditions and provisions of this ordinance are hereby repealed to the extent of such irreconcilable conflict.

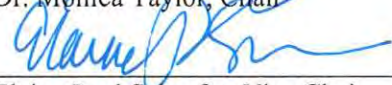
SECTION 3. The terms, conditions and provisions of this ordinance are hereby declared to be severable, and should any portion, part or provision of this ordinance be found by a court of competent jurisdiction to be invalid, unenforceable or unconstitutional, County Council hereby declares its intent that the ordinance shall have been enacted without regard to the invalid, unenforceable or unconstitutional portion, part or provision of this ordinance.

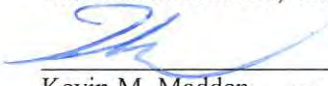
SECTION 4. This Ordinance shall take effect on the tenth day after its adoption.

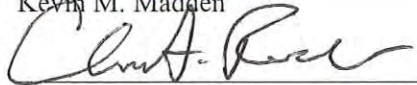
ENACTED AND ORDAINED by County Council of the County of Delaware, Pennsylvania,
this 15 day of June 2022.

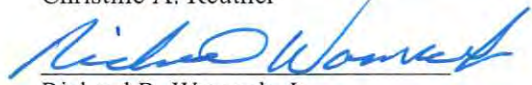
COUNTY OF DELAWARE


Dr. Monica Taylor, Chair


Elaine Paul Schaefer, Vice Chair


Kevin M. Madden


Christine A. Reuther


Richard R. Womack, Jr.

Attested:


Anne M. Coogan
County Clerk

Exhibit A

Chapter 29 CONTRACTORS

§ 29-1. Purpose

- A. Delaware County recognizes that there is a need to ensure that all work on public construction and maintenance contracts is performed by responsible, qualified firms that maintain the capacity, expertise, personnel and other qualifications and resources necessary to successfully perform such contracts in a timely, reliable and cost-effective manner.
- B. To effectuate the purpose of selecting responsible contractors for these public contracts and to protect Delaware County's investments in such contracts, prospective contractors and sub-contractors should be required to meet pre-established, clearly defined, minimum qualification standards regarding past project performance in terms of competency, safety and law compliance, technical abilities, experience, and adequacy of resources.
- C. Further, due to the critical impact that skilled craft labor has on the execution of public works projects, and the increasingly limited availability of such labor, it is necessary to require contractors and subcontractors to participate in proven apprenticeship training programs as a condition of bidding to promote successful project delivery and help ensure future workforce development.
- D. Therefore, Delaware County shall require compliance with the provisions of this Chapter by business entities seeking to provide services as specified herein. The requirements of this Chapter are intended to supplement, not replace, existing contractor qualification standards or other criteria currently required by Delaware County. However, in the event that this Chapter conflicts with any law, public policy or contracting documents of Delaware County, the requirements of this Chapter shall prevail.

§ 29-2. Responsible Contractor Requirements

- A. This Chapter shall apply to contracts valued at \$500,000 or more for public works projects undertaken by Delaware County for construction, demolition, alteration, renovation, modernization, service or maintenance of buildings, structures or facilities. All contractors and subcontractors of any tier that perform work on such projects, regardless of value of individual contract or subcontract packages shall meet the requirements of this Chapter.
- B. All firms engaged in public works contracts subject to this Chapter, including general contractors, construction managers, other lead or prime contractors, and subcontractors at any level, shall be qualified, responsible contracting firms that have sufficient capabilities in all respects to successfully perform contracts on which they are engaged, including the necessary experience, equipment, technical skills and qualifications and organizational, financial and personnel resources. Firms bidding or otherwise participating in public works contracts shall also be required to have a satisfactory past performance record and a satisfactory record of law compliance, integrity and business ethics.
- C. This Chapter does not apply to work incident to the installation of specialized equipment pursuant to either warranty requirements or manufacturers' requirements.
- D. Compliance with this Chapter and compliance with the provisions of Article V (Central Purchasing) of the Administrative Code are separate requirements which need to be independently satisfied.

§ 29-3. Contractor Responsibility Certifications

- A. As a condition of performing work on a public works contract subject to this Chapter, a general contractor, construction manager or other lead or prime contractor seeking award of a contract shall submit a Contractor Responsibility Certification as specified herein.

- B. The Contractor Responsibility Certification shall be completed on a form provided by Delaware County and reference the project for which a bid is being submitted by name and contract or project number.
- C. In the Contractor Responsibility Certification the construction manager, general contractor or other lead or prime contractor shall confirm the following facts regarding its past performance and work history and its current qualifications and performance capabilities:
- (1) The firm and its employees have all licenses, registrations, certificates or other credentials required by federal and state law and the laws of Delaware County
with respect to the contract work it seeks to self-perform.
 - (2) The firm meets the bonding requirements for the contract required by law or contract specifications, as well as applicable insurance requirements for the contract, including general liability, workers compensation and unemployment insurance.
 - (3) The firm has not been debarred or suspended by any federal, state or local government agency or authority in the past three years.
 - (4) The firm has not defaulted on any project in the past three years.
 - (5) The firm has not had any type of business, contracting or trade license, registration or certification revoked or suspended in the past three years.
 - (6) The firm and its principals/owners have not been convicted of any crime relating to its contracting business in the past ten years.
 - (7) Within the past three years, the firm has not been found in violation of any law applicable to its contracting business, including, but not limited, to licensing laws, tax laws, wage and hour laws, prevailing wage laws, environmental laws or others, where the result of such violation was the payment of a fine, back pay damages or any other type of penalty in the amount of \$5,000 or more.
 - (8) The firm will employ a sufficient number of craft labor personnel required to successfully perform any project work it self-performs or shall use qualified subcontractors to meet this requirement and shall assign workers to perform only work in their respective craft or trade for which they have sufficient skills and training, or shall use qualified subcontractors to meet this requirement.
 - (9) The firm will pay all craft employees on the project, at a minimum, the applicable wage and fringe benefit rates, as established for the classification in which the worker is employed, in accordance with the Pennsylvania Prevailing Wage Act (43 P.S. § 165-1 et seq.).
 - (10) The firm will ensure that all craft labor it employs on the project will have completed, prior to working on the project the OSHA 10-hour training course for safety established by the U.S. Department of Labor. If the firm is a prime contractor, it shall also ensure that at least one person on the project has completed the OSHA 30-hour construction training course established by the U.S. Department of Labor
 - (11) The firm participates in a Class A Apprenticeship Training Program, as defined below, for each separate trade or classification in which it employs craft employees.
 - (a) For purposes of this section, a Class A Apprenticeship Program is an apprenticeship program registered with and approved by the U.S. Department of Labor or a state apprenticeship agency and has graduated apprentices to journey person status for at least three of the past five years. This may be an apprenticeship program subject to the Employee Retirement Income Security Act of 1974, 29 U.S.C. § 1001 et seq. ("ERISA"), or a non-ERISA program.
 - (b) To demonstrate compliance with this section, the firm shall provide, with this certification, a list of all trades or classifications of craft employees it will employ on the project and

documentation verifying it participates in a Class A Apprenticeship Program for each trade or classification listed.

- (c) The requirements of this section and Section 29-3.C(12) help ensure that the bulk of the craft labor workforce employed on the project will have sufficient skills and training to correctly perform work assigned to them.
- (12) The construction manager, general contractor or other lead or prime contractor responsible for the project shall ensure that at least 70 percent of the craft labor workers employed on the project shall be comprised of either journey person workers who have successfully completed a Class A Apprenticeship Program as defined in Section 29-3.C(10) or apprentices registered in such programs. The apprenticeship participation of specified by this section must be in the same trade or craft for which the workers are employed on the project.
- (13) The firm shall assign craft labor personnel only work in the craft or trade in which they are employed.
- (14) The firm has all other technical qualifications and resources, including equipment, personnel and financial resources, to successfully perform the referenced contract and shall maintain such capabilities throughout the duration of the project, or will obtain same through the use of qualified, responsible subcontractors or vendors
- (15) The firm shall notify Delaware County within seven days of any material changes in its operation that relate to any matter attested to in this certification.
- D. Execution of the Contractor Responsibility Certification required by this Chapter shall not establish a presumption of contractor responsibility, and Delaware County may require any additional information it deems necessary to evaluate a firm's status as a responsible contractor, including information regarding the firm's technical qualifications, financial capacity or other resources and performance capabilities. Delaware County may require that such information be included in a separate Statement of Qualifications and Experience or as an attachment to the Contractor Responsibility Certification.
- E. The submitting firm shall stipulate in the Contractor Responsibility Certification that, if it receives a Notice of Intent to Award Contract, it will provide a Subcontractor List and required subcontractor information as specified in Section 29-5.
- F. If the submitting firm has ever operated under another name or is controlled by another company or business entity or in the past five years controlled or was controlled by another company or business entity, whether as a parent company, subsidiary or in any other business relation, it shall attach an appendix to its Contractor Responsibility Certification that explains in detail the nature of any such relationship. Additional information may be required from such an entity if the relationship in question could potentially impact contract performance.
- G. If a firm fails to provide a Contractor Responsibility Certification required by this section, it may be disqualified from bidding. No action of any nature shall lie against Delaware County because of its refusal to accept a bid for this reason.

§ 29-4. Notice of Intent to Award Contract

- A. After it has received bids for a project, Delaware County shall issue a Notice of Intent to Award Contract to the firm that has submitted the lowest responsive bid.
- B. Such Notice shall be issued immediately or as soon as practicable after bids are opened and shall stipulate that the contract award is conditioned on the issuance of a written Contractor Responsibility Determination for the firm as required by Section 29-6, compliance with Subcontractor Certifications required by Section 29-5, and any other qualification standards required by Delaware County.

§ 29-5. Subcontractor Responsibility Requirements

- A. Within fourteen (14) days of receiving a Notice of Intent to Award Contract, the prospective awardee shall submit a Subcontractor List, which provides the name and address of the subcontractors it will use on the project, the scope of work assigned to each subcontractor, and Subcontractor Responsibility Certifications as required by this section. The Director of Public Works may extend such deadline for submission upon good justification from a prospective awardee as to the delayed response.
- B. The prospective awardee shall not be permitted to use a subcontractor on any work performed for Delaware County unless it has identified the subcontractor on its Subcontractor List and provided a Subcontractor Responsibility Certification in accordance with the requirements of Section 29-5.
- C. At the time a prospective awardee submits the Subcontractor List it shall also submit Subcontractor Responsibility Certifications and applicable supporting information for all listed subcontractors to Delaware County.
- D. A prospective awardee shall determine whether any firm on its Subcontractor List is organized as a sole proprietorship owned and operated by a single person. This shall apply to subcontractors at any tier. For any such entity, the prospective awardee shall ensure that the sole proprietorship subcontractor is a legitimate business entity and not a misclassified employee by requiring the subcontractor to supplement its Subcontractor Certification with its Employer Identification Number and copies of any license, certificate or registration it is required to maintain in to do business in the state in which it is located.
- E. Subcontractor Responsibility Certifications shall be executed by the respective subcontractors on forms prepared by Delaware County and contain the same information, representations and supporting information required in Contractor Responsibility Certifications, including verification of apprenticeship qualifications required by Section 29-3.C(11) for each trade or classification of craft workers it will employ on the project.
- F. Subcontractor Responsibility Certifications shall be executed by a person having sufficient knowledge to address all matters in the certification and shall include an attestation stating, under the penalty of perjury, that all information submitted is true, complete and accurate.
- G. A subcontractor listed on a firm's Subcontractor List shall not be substituted unless written authorization is obtained from Delaware County and a Subcontractor Responsibility Certification is provided for the substitute subcontractor.
- H. In the event that Delaware County determines that a subcontractor fails to meet the requirements of this Chapter or is otherwise determined to be non-responsible, it may, after informing the prospective awardee, exercise one of the following options:
 - (1) Permit the awardee to substitute a qualified, responsible subcontractor in accordance with the requirements of this section, upon submission of a completed Subcontractor Certification for the substitute and approval of the substitute by Delaware County.
 - (2) Require the awardee to self-perform the work in question if the firm has the required experience, licenses and other qualifications to perform the work in question; or
 - (3) Disqualify the prospective awardee.
- I. In the event a subcontractor is disqualified under this Chapter, the general contractor, construction manager or other lead or prime contractor shall not be permitted to make any type of claim against Delaware County on the basis of a subcontractor disqualification.

§ 29-6. Contractor Responsibility Review and Determination

- A. After Delaware County has issued a Notice of Intent to Award Contract to the lowest responsive bidder, it shall undertake a contractor responsibility review process to determine whether the firm is a

qualified, responsible firm in accordance with the requirements of this Chapter and other applicable laws and regulations. The time frame for conducting this review process shall be as determined by Delaware County.

- B. As part of the review process, Delaware County shall ensure that the Contractor Responsibility Certification and Subcontractor Responsibility Certifications and applicable supporting information comply with the requirements of this Chapter.
- C. Delaware County may conduct any additional inquiries to verify that the prospective awardee and its subcontractors have the technical qualifications and performance capabilities necessary to successfully perform the contract and that the firms have a sufficient record of law compliance and business integrity to justify the award of a public contract. In conducting such inquiries, Delaware County may seek relevant information from the firm, its prior clients or customers, its subcontractors or any other relevant source.
- D. After Delaware County determines that all responsibility certifications have been properly executed and has verified that all other relevant information requested for reviews indicates that the prospective awardee and its subcontractors are qualified, responsible firms, it shall issue a written Contractor Responsibility Determination for the prospective awardee.
- E. In the event a firm is determined to be non-responsible, Delaware County shall notify the firm and proceed to conduct a responsibility review of the next lowest, responsive bidder or, if necessary, rebid the project. A Responsibility Determination may be revoked at any time if Delaware County obtains relevant information warranting any such revocations.

§ 29-7. Execution of Final Contract

- A. A contract subject to this Chapter shall not be executed until all requirements of this Chapter have been fulfilled and until a Contractor Responsibility Determination has been issued by Delaware County pursuant to Section 29-6.
- B. Prior to the execution of a final contract under this Section, Delaware County shall publicly post the Notice of Intent to Award, Contractor and Subcontractor Responsibility Certifications, Subcontractor Lists, related supporting documentation and the Contractor Responsibility Determination on a publicly available website for public inspection for a period of ten (10) calendar days after the issuance of the Contractor Responsibility Determination.

§ 29-8. False, Incomplete or Misleading Responsibility Certifications.

- A. If Delaware County determines that a Contractor Certification, Subcontractor List or Subcontractor Responsibility Certification contains false or misleading information that was provided knowingly or with reckless disregard for the truth or omits material information knowingly or with reckless disregard of the truth, the firm for which the certification was submitted shall be disqualified from the project and shall be prohibited from performing work for Delaware County for a period of three years. Delaware County may withhold payment of any monies due to the firm as damages and impose other applicable penalties and sanctions, including contract termination, as permitted by law or contract.



COUNTY OF DELAWARE

Subcontractor Responsibility Certification

Chapter 29 of the Delaware County Code requires that as a condition of performing work on certain public works contracts, a firm seeking award of a contract shall submit Subcontractor Responsibility Certification for all identified subcontractors. Delaware County has determined that the contract subject to this solicitation is covered by Chapter 29, and that firms responding to this solicitation must submit this form for all subcontractors.

In order for this Subcontractor Responsibility Certification to be considered validly submitted, it must be properly signed by the subcontractor or an officer or employee of the subcontractor authorized to make it. Subcontractor Responsibility Certifications that are not properly signed will not be considered as responsive to the requirements of the Delaware County Code.

Execution of this Subcontractor Responsibility Certification shall not establish a presumption of subcontractor responsibility, and Delaware County may require any additional information it deems necessary to evaluate a subcontractor's status as a responsible contractor, including information regarding the firm's technical qualifications, financial capacity or other resources and performance capabilities.

If Delaware County determines that a Subcontractor Responsibility Certification contains false or misleading information that was provided knowingly or with reckless disregard for the truth or omits material information knowingly or with reckless disregard of the truth, the firm for which the certification was submitted shall be disqualified from the project and shall be prohibited from performing work for Delaware County for a period of three years. Delaware County may withhold payment of any monies due to the firm as damages and impose other applicable penalties and sanctions, including contract termination, as permitted by law or contract.

I hereby represent, warrant and agree on behalf of the firm indicated below that:

Acknowledged*

(1) The subcontractor and its employees have all licenses, registrations, certificates or other credentials required by federal and state law and the laws of Delaware County with respect to the contract work it seeks to self-perform.

☐

(2) The subcontractor meets the bonding requirements for the contract required by law or contract specifications, as well as applicable insurance requirements for the contract, including general liability, workers compensation and unemployment insurance.

☐

- (3) The subcontractor has not been debarred or suspended by any federal, state or local government agency or authority in the past three years. ☐
- (4) The subcontractor has not defaulted on any project in the past three years. ☐
- (5) The subcontractor has not had any type of business, contracting or trade license, registration or certification revoked or suspended in the past three years. ☐
- (6) The subcontractor and its principals/owners have not been convicted of any crime relating to its contracting business in the past ten years. ☐
- (7) Within the past three years, the subcontractor has not been found in violation of any law applicable to its contracting business, including, but not limited, to licensing laws, tax laws, wage and hour laws, prevailing wage laws, environmental laws or others, where the result of such violation was the payment of a fine, back pay damages or any other type of penalty in the amount of \$5,000) or more. ☐
- (8) The subcontractor will employ a sufficient number of craft labor personnel required to successfully perform any project work and shall assign workers to perform only work in their respective craft or trade for which they have sufficient skills and training. ☐
- (9) The subcontractor will pay all craft employees on the project, at a minimum, the applicable wage and fringe benefit rates, as established for the classification in which the worker is employed, in accordance with the Pennsylvania Prevailing Wage Act (43 P.S. § 165-1 et seq.). ☐
- (10) The subcontractor will ensure that all craft labor it employs on the project will have completed, prior to working on the project the OSHA 10-hour training course for safety established by the U.S. Department of Labor. ☐
- (11) The subcontractor participates in a Class A Apprenticeship Training Program for each separate trade or classification in which it employs craft employees. ☐
- (a) A "Class A Apprenticeship Program" is an apprenticeship program registered with and approved by the U.S. Department of Labor or a state apprenticeship agency and has graduated apprentices to journey person status for at least three of the past five years. This may be an apprenticeship program subject to the Employee Retirement Income Security Act of 1974, 29 U.S.C. § 1001 et seq. ("ERISA"), or a non-ERISA program.
- (b) To demonstrate compliance with this section, the subcontractor shall provide, with this certification, a list of all trades or classifications of craft employees it will employ on the project and documentation verifying it participates in a Class A Apprenticeship Program for each trade or classification listed. See Attachment 1.
- (12) The subcontractor shall assign craft labor personnel only work in the craft or trade in which they are employed. ☐
- (13) The subcontractor has all other technical qualifications and resources, including equipment, personnel and financial resources, to successfully perform the referenced contract and shall maintain such capabilities throughout the duration of ☐

the project, or will obtain same through the use of qualified, responsible subcontractors or vendors

(14) The subcontractor shall notify Delaware County within seven days of any material changes in its operation that relate to any matter attested to in this certification. ☐

(15) If the submitting subcontractor has ever operated under another name or is controlled by another company or business entity or in the past five years controlled or was controlled by another company or business entity, whether as a parent company, subsidiary or in any other business relation, it shall attach as Attachment 2 hereto that explains in detail the nature of any such relationship. Additional information may be required from such an entity if the relationship in question could potentially impact contract performance. ☐

(16) If you are organized as a sole proprietorship owned and operated by a single person, to ensure that you are a legitimate business entity and not a misclassified employee, you must submit as Attachment 3 your Employer Identification Number and copies of any license, certificate or registration you are required to maintain in to do business in the state in which it is located. ☐

(17) The subcontractor and its owners have not declared bankruptcy in the past three (3) years. ☐

(18) The subcontractor has not committed or been cited for a willful violation of federal or state safety laws as determined by a final decision of a court or government agency in the past three (3) years. ☐

(19) The subcontractor will notify, in writing, the Delaware County Department of Public Works within seven (7) days of any material change to any of the above certifications. ☐

****Please check each box to acknowledge that you have read the corresponding representation/warranty/agreement.***

By executing below, you declare and certify that:

- (A) You are an employee or officer of the subcontractor who is duly authorized to execute this Contractor Responsibility Certification.
- (B) Have sufficient knowledge to address all matters in this Contractor Responsibility Certification and attest that all information submitted is true, complete and accurate. This attestation is made subject to the penalties and provisions of 18 Pa. C.S.A. §4904 relating to unsworn falsification to authorities.

Name of Subcontractor: _____

By: _____

Name:

Title:

Date:

Attachment 1

Class A Apprenticeship Program

[Subcontractor to attach a list of all trades or classifications of craft employees it will employ on the project and documentation verifying it participates in a Class A Apprenticeship Program per paragraph 11(b).]

Attachment 2

Prior Names/Organization Changes

[Subcontractor to attach additional information if required under Paragraph (15).]

Attachment 3

Sole Proprietorship Information

[Subcontractor to attach additional information if required under Paragraph (16).]



COUNTY OF DELAWARE

Contractor Responsibility Certification

Chapter 29 of the Delaware County Code requires that as a condition of performing work on certain public works contracts, a firm seeking award of a contract shall submit a Contractor Responsibility Certification. Delaware County has determined that the contract subject to this solicitation is covered by Chapter 29, and that firms responding to this solicitation must submit this form and otherwise comply with the provisions of Chapter 29 as well as Delaware County Resolution Number 2022-3 (Regarding Goals for Diversity in Public Works Contracting).

In order for this Contractor Responsibility Certification to be considered validly submitted, it must be properly signed by the firm or an officer or employee of the Contractor authorized to make it. Contractor Responsibility Certifications that are not properly signed will not be considered as responsive to the requirements of the Delaware County Code. If a firm fails to provide a Contractor Responsibility Certification required by this section, it may be disqualified from bidding/responding. No action of any nature shall lie against Delaware County because of its refusal to accept a bid/response for this reason.

Execution of this Contractor Responsibility Certification shall not establish a presumption of contractor responsibility, and Delaware County may require any additional information it deems necessary to evaluate a firm's status as a responsible contractor, including information regarding the firm's technical qualifications, financial capacity or other resources and performance capabilities.

If Delaware County determines that a Contractor Certification, Subcontractor List or Subcontractor Responsibility Certification contains false or misleading information that was provided knowingly or with reckless disregard for the truth or omits material information knowingly or with reckless disregard of the truth, the firm for which the certification was submitted shall be disqualified from the project and shall be prohibited from performing work for Delaware County for a period of three years. Delaware County may withhold payment of any monies due to the firm as damages and impose other applicable penalties and sanctions, including contract termination, as permitted by law or contract.

I hereby represent, warrant and agree on behalf of the firm indicated below that:

Acknowledged*

- (1) The firm and its employees have all licenses, registrations, certificates or other credentials required by federal and state law and the laws of Delaware County with respect to the contract work it seeks to self-perform. ☐
- (2) The firm meets the bonding requirements for the contract required by law or contract specifications, as well as applicable insurance requirements for the contract, including general liability, workers compensation and unemployment insurance. ☐

- (3) The firm has not been debarred or suspended by any federal, state or local government agency or authority in the past three years. ☐
- (4) The firm has not defaulted on any project in the past three years. ☐
- (5) The firm has not had any type of business, contracting or trade license, registration or certification revoked or suspended in the past three years. ☐
- (6) The firm and its principals/owners have not been convicted of any crime relating to its contracting business in the past ten years. ☐
- (7) Within the past three years, the firm has not been found in violation of any law applicable to its contracting business, including, but not limited, to licensing laws, tax laws, wage and hour laws, prevailing wage laws, environmental laws or others, where the result of such violation was the payment of a fine, back pay damages or any other type of penalty in the amount of \$5,000) or more. ☐
- (8) The firm will employ a sufficient number of craft labor personnel required to successfully perform any project work it self-performs or shall use qualified subcontractors to meet this requirement and shall assign workers to perform only work in their respective craft or trade for which they have sufficient skills and training, or shall use qualified subcontractors to meet this requirement. ☐
- (9) The firm will pay all craft employees on the project, at a minimum, the applicable wage and fringe benefit rates, as established for the classification in which the worker is employed, in accordance with the Pennsylvania Prevailing Wage Act (43 P.S. § 165-1 et seq.). ☐
- (10) The firm will ensure that all craft labor it employs on the project will have completed, prior to working on the project the OSHA 10-hour training course for safety established by the U.S. Department of Labor. If the firm is a prime contractor, it shall also ensure that at least one person on the project has completed the OSHA 30-hour construction training course established by the U.S. Department of Labor ☐
- (11) The firm participates in a Class A Apprenticeship Training Program for each separate trade or classification in which it employs craft employees. ☐
- (a) A "Class A Apprenticeship Program" is an apprenticeship program registered with and approved by the U.S. Department of Labor or a state apprenticeship agency and has graduated apprentices to journey person status for at least three of the past five years. This may be an apprenticeship program subject to the Employee Retirement Income Security Act of 1974, 29 U.S.C. § 1001 et seq. ("ERISA"), or a non-ERISA program.
- (b) To demonstrate compliance with this section, the firm shall provide, with this certification, a list of all trades or classifications of craft employees it will employ on the project and documentation verifying it participates in a Class A Apprenticeship Program for each trade or classification listed. See Attachment 1.
- (12) The construction manager, general contractor or other lead or prime contractor responsible for the project shall ensure that at least 70 percent of the craft labor workers employed on the project shall be comprised of either journey person ☐

workers who have successfully completed a Class A Apprenticeship Program or apprentices registered in such programs. The apprenticeship participation of specified by this section must be in the same trade or craft for which the workers are employed on the project.

(13) The firm shall assign craft labor personnel only work in the craft or trade in which they are employed. ☐

(14) The firm has all other technical qualifications and resources, including equipment, personnel and financial resources, to successfully perform the referenced contract and shall maintain such capabilities throughout the duration of the project, or will obtain same through the use of qualified, responsible subcontractors or vendors ☐

(15) The firm shall notify Delaware County within seven days of any material changes in its operation that relate to any matter attested to in this certification. ☐

(16) If the submitting firm has ever operated under another name or is controlled by another company or business entity or in the past five years controlled or was controlled by another company or business entity, whether as a parent company, subsidiary or in any other business relation, it shall attach as Attachment 2 hereto that explains in detail the nature of any such relationship. Additional information may be required from such an entity if the relationship in question could potentially impact contract performance. ☐

(17) Please include a proposed Subcontractor List as Attachment 3. If the firm receives a Notice of Intent to Award Contract, it agrees to: (a) provide Subcontractor Responsibility Forms and any required subcontractor information within fourteen days (Director of Public Works may extend such deadline upon good justification by firm); and (b) provide any reasonably requested supporting documentation as part of Delaware County's contractor responsibility review process. ☐

(18) The firm and its owners have not declared bankruptcy in the past three (3) years. ☐

(19) The firm has not committed or been cited for a willful violation of federal or state safety laws as determined by a final decision of a court or government agency in the past three (3) years. ☐

(20) The firm will notify, in writing, the Delaware County Department of Public Works within seven (7) days of any material change to any of the above certifications. ☐

****Please check each box to acknowledge that you have read the corresponding representation/warranty/agreement.***

By executing below, you declare and certify that:

- (A) You are an employee or officer of the firm who is duly authorized to execute this Contractor Responsibility Certification.
- (B) Have sufficient knowledge to address all matters in this Contractor Responsibility Certification and attest that all information submitted is true, complete and accurate. This attestation is made subject to the penalties and provisions of 18 Pa. C.S.A. §4904 relating to unsworn falsification to authorities.

Name of Firm: _____

By: _____

Name:

Title:

Date:

Exhibit A

Diversity Goal Contract Provisions

Pursuant to Delaware County Resolution Number 2022-3 Regarding Goals for Diversity in Public Works Contracting, the following provisions will be required in any contract resulting from this solicitation.

- a. The contractor will make a good faith effort to employ local residents for completion of the project, when it has a need for new employees, in an effort to meet a goal of 10% local worker participation on the project. Good faith effort shall include, but not be limited to: hosting a public job fair prior to the commencement of the Project open to residents of Delaware County, posting of available employment opportunities with the Delaware County Workforce Development Board and its PACareerLink offices, providing employment and training services, advertisement of employment opportunities in a newspaper of general circulation throughout Delaware County, and internet advertisements.
- b. The contractor will make a good faith effort to employ minority and female craftspeople for completion of the qualified project when such contractor has a need for new employees to complete the project, in an effort to meet the goal of having 10% minority and female participation on the project. Good faith effort shall include, but not be limited to: hosting a public job fair prior to the commencement of the Project open to all applicants in an attempt to identify, hire and utilize minority and female craftspeople, the posting of available employment opportunities with the Delaware County Workforce Development Board and its PACareerLink offices, providing employment and training services, advertisement of employment opportunities in a newspaper of general circulation throughout Delaware County, and internet advertisements.
- c. The contractor shall, as a material condition of the contract, make a good faith effort to utilize veteran owned businesses, minority owned businesses, women owned businesses and small business enterprises on the qualified project. "Minority owned business" shall mean that at least 51% of the business is owned by an individual who is a United States citizen or permanent resident alien who has and can demonstrate membership in one of the following groups: Black persons having origins in any of the Black African racial groups; Hispanic persons of Mexican, Puerto Rican, Dominican, Cuban, Central or South American Descent of either Indian or Hispanic origin, regardless of race; Native American or Alaskan native persons having origins in any of the original peoples of North America; Asian and Pacific Islander persons having origins in any of the Far East countries, South East Asia, the Indian subcontinent or the Pacific Islands. "Small business enterprise" shall mean a business with an annual gross income which is determined by the United States Small Business Administration to qualify it as a small business enterprise.

Attachment 1

Class A Apprenticeship Program

[Firm to attach a list of all trades or classifications of craft employees it will employ on the project and documentation verifying it participates in a Class A Apprenticeship Program per paragraph 11(b).]

Attachment 2

Prior Names/Organization Changes

[Firm to attach additional information if required under Paragraph (16).]

Attachment 3

Subcontractor List

[Must include name, phone number, address and type of work to be performed for each subcontractor].

Section K
Contractor's Qualification Statement

CONTRACTOR'S QUALIFICATION STATEMENT

Contractor shall submit AIA Document A305 – 1986, Contractor's Qualification Statement, with Bid. (See Appendix B)

FORM OF CONTRACT

Article of Agreement made this _____ day of _____
_____, 20___ between _____

_____(hereinafter called Contractor)
and the County of Delaware (hereinafter called County).

WITNESSETH:

That the Contractor covenants, promises, and agrees to and with the County to

For the price or sum of _____

as per its annexed Bid, and to in all respects comply with the terms and
conditions of the Annexed Proposal, Invitation to Bidders, Instructions to Bidders,
General Conditions, Specifications and Drawings and the County covenants,
promises, and agrees to and with the Contractor to pay it in the price of _____

for _____

It is further mutually agreed by said parties, in consideration of their aforesaid
mutual covenants, that the annexed Invitation to Bidders, Proposal, General
Conditions and Specifications annexed thereto constitute and are a part of the
Contract as though fully set forth therein.

Section L
Form of Contract

In Witness Whereof, the Contractor and the County have hereunto caused their common of corporate Seals to be affixed hereto duly attested by their proper Officers the day and year aforesaid.

Attest: _____
Secretary or Assistant Secretary

COUNTY OF DELAWARE

Chairman

Attest: _____
County Clerk

Date: _____

LABOR AND MATERIALS BOND

KNOW ALL PERSONS BY THESE PRESENTS that _____
(Principal) and _____ (Surety) are held and firmly
bound unto the County of Delaware in the Commonwealth of Pennsylvania, (hereinafter called
County), in the sum of: _____ lawful money of the United States of America, to
which payment well and truly to be made, we do hereby jointly and severally bind and oblige
ourselves, and our respective successors and assigns firmly by these presents:

Sealed with our Seals this _____ day of _____ 20 _____.

Whereas, the bounden Principal has entered into a written Contract with the County to:

for the price or sum of _____
which Contract by reference is made a part hereof:

Now, therefore, the condition of this obligation is such that if the above bounden Principal shall and
will promptly pay or cause to be paid all sums of money which may be due any person, co-
partnership, association or corporation for all materials furnished and labor supplied or performed in
the prosecution of the work whether or not the same material or labor enter into and become
component parts of the work or improvement contemplated, then this obligation to be void and of no
effect, otherwise, to continue in full force and virtue.

The Principal and Surety further and severally agree with the Obligees herein that every person, co-
partnership, association or corporation who whether as sub-contractor or otherwise, has furnished
material or supplied or performed labor in the prosecution of the work as above mentioned and who
has not been paid therefore, may use in assumpsit on this bond in the name of the County of
Delaware, Obligees for his, their or its use, prosecute the same to final judgment for such sum or
sums as may be justly due him, them or it, and have execution thereon, provided, however, that
Obligees shall not be liable for the payment of any costs or expense of any such suit.

Recovery by any person, co-partnership, association or corporation hereunder shall be subject to
the provisions of the Act of the General Assembly No. 869 approved December 20, 1967, to the
same extent as if said Provisions were fully incorporated in this Bond.

It is further agreed that any alterations which may be made in terms of the Contractor in the work to
be done or materials to be furnished or labor to be supplied or performed under it or the giving of the
Obligees or the Principal and the Surety or Sureties or either or any of them their prospective
successors and assigns, from their liability hereunder, notice to the Surety or Sureties of any such
alteration, extension or forbearance being hereby waived.

Section M
Labor and Materials Bond

In Witness Whereof, the Principal and the Surety have hereunto caused their Common Corporate Seals to be affixed hereto duly attested by their proper Officer the day and year aforesaid.

Attest: _____
(Secretary or Assistant Secretary)

(Principal)

Sealed and delivered in the presence of:

(Surety)

Section M
Performance Bond

PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS, that _____
(PRINCIPAL) and _____ (SURETY) are held and firmly bound unto the
County of Delaware in the Commonwealth of Pennsylvania (hereinafter called County) in
the sum of: \$_____, lawful money of the United States of America, to
which payment well and truly to be made, we do hereby jointly and severally bind and
oblige ourselves and our respective successors and assignees firmly by these presents:

Sealed with our Seals this _____ day of _____ 20____.

Whereas, the above bounden Principal has entered into a written Contract with the
County to:

for the prices set forth in said Proposal, which said Contract, is by reference made a part
thereof.

Now the Condition of this obligation is such that if the above bounden Principal shall well
and truly perform said Contract and fully and faithfully carry out and complete the same
in all respects then this obligation shall be void and of no effect, otherwise, to continue in
full force and virtue.

AND FURTHER, we do in the event of default, hereby authorize and empower any
attorney of the Court of Common Pleas of the County of Delaware, Pennsylvania, or any
other Court of record elsewhere, or any Prothonotary or Clerk of said Courts, to appear for
us, our heirs, executors, administrators, successors or assigns, at the suit of the County of
Delaware, its successors, or assigns obligee in the above obligations as of any term, after
the date thereof, or hereof, and thereupon to confess judgment against us or against our
heirs, executors, administrators, successors or assigns for the above sum
_____ Dollars (\$_____)
debt, besides the cost of suite and any attorney's fee of ten percent (10%) without stay of
execution and inquisition upon any levy upon real estate is hereby waived, and
condemnation agreed to and the exemption of personal property from levy and sale on
any execution under and by virtue of any exemption law now in force, or which may be
hereafter passed, is also waived.

In Witness Whereof, the Principal and the Surety have hereunto caused their common or
Corporate Seals to be affixed hereto duly attested by their Officers, the day and year
aforesaid.

Attest: _____
Secretary or Assistant Secretary

Principal

Sealed and delivered in the presence of:

Surety

Section M
Maintenance Bond

MAINTENANCE BOND

KNOW ALL MEN BY THESE PRESENTS:

THAT WE _____
Name and Address of Contractor

OR WE _____
Name and Address of Partnership

(or if a corporation with address and state in which incorporated) (herein after called the "Principal"), as Principal, and _____
Name of Surety and Address

a corporation of the State of _____ with offices in the Commonwealth of Pennsylvania and licensed to do business in the Commonwealth of Pennsylvania (hereinafter called "Surety"), as Surety are held and firmly bound unto the County of Delaware in said Commonwealth (hereinafter called "Owner"), in the full and just sum of _____ Dollars (\$ _____) lawful money of the United States of America, to be paid to the said Principal and Surety bind themselves and their respective heirs, administrators, executors, successors and assigns, jointly and severally firmly by these presents.

Signed, sealed and dated this _____ day of _____ 20 ____.

WHEREAS, the Principal has entered into a certain contract with the Owner dated this _____ day of _____ A.D., 20____, to furnish:

in said County and Commonwealth, in strict conformance with the Specifications, a copy of which is or may be hereto attached.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall remedy, without cost to the said Owner, any defect which may develop during the period of one (1) year from the date of completion, and acceptance of the work performed under said Contract, provided such defects, in the judgment of said Owner, are caused by defective or inferior materials or workmanship, then this obligation shall be null and void, otherwise remain in full force and virtue. AND FURTHER, we do in the event of default; hereby authorize and empower any attorney of the Court of Common Pleas of the County of Delaware, Pennsylvania, or any other Court of record elsewhere, or any Prothonotary or Clerk of Said Courts, to appear for us. our heirs, executors, administrators, successors or assigns, at the suit of the Owner, its successors, or

Section M
Maintenance Bond

assigns oblige in the above obligations as of any term, after the date thereof or hereof and thereupon to confess judgment against us or against our heirs, executors, administrators, successors or assigns for the above sum of: _____ Dollars (\$ _____) debt, besides the cost of suit and an attorney's fee of ten percent (10%) without stay of execution and inquisition upon any levy upon real estate is hereby waived, and condemnation agreed to and the exemption of personal property from levy and sale on any execution under and by virtue of any exemption law now in force, or which may be hereafter be passed, is also waived.

Attest: _____
Secretary or Assistant Secretary

Principal

Sealed and delivered in the presence of:

Surety

Section N
Waiver of Liens

WAIVER OF LIENS

WHEREAS, entered into a contract with _____

to provide materials and perform labor necessary for _____

upon a lot of ground located _____

NOW, THEREFORE, it is hereby stipulated and agreed by and between the said parties, as part of the said contract and for the consideration therein set forth, that neither the undersigned contractor, any sub-contractor or material man, nor any other person furnishing labor or materials to the said contractor under this contract shall file a lien, commonly called a mechanic's lien, for work done or materials furnished to remove the said bridge or any part thereof.

This stipulation is made and intended to be filed with the County Prothonotary in accordance with the requirements of Section 1402 of the Mechanics Lien Law of 1963 of the Commonwealth of Pennsylvania in such case provided.

IN WITNESS WHEREOF, the said parties hereto have hereunto set their hands and seals this ____ day of _____, 20____.

COUNTY OF DELAWARE

By: _____
Authorized Signature

Attest:

CONTRACTOR

By: _____

By: _____
Authorized Signature

Typed Name & Title

Section O
Statement of Surety Company

STATEMENT OF SURETY COMPANY

Delaware County Contract No. eDPW-121422-2

In accordance with the provisions of the Contract dated _____
between the County of Delaware, Pennsylvania, and:

_____,
the _____ company of _____ Surety on
the Bonds of _____,
after a careful examination of the books and records of said Contractor or after
receipt of an Affidavit from Contractor, which examination or Affidavit satisfies
this Company that all claims for labor and materials have been satisfactorily
settled, hereby approve the final payment of the said
_____ Contractor and by
these presents witness that payment to the Contractor of the final payment shall
not relieve the Surety Company of any of its obligations to the County of
Delaware, Pennsylvania, as set forth in the said Surety Company's Bonds.

IN WITNESS WHEREOF, the said Surety Company has hereunto set its hand
and seal this

_____ day of _____, 20____.

Attest:

(SEAL) _____ BY: _____
President

NOTE: This statement, if executed by any person other than the President of
the Company, must be accompanied by a certificate of even date
showing authority conferred upon the person so signing to execute
such instruments on behalf of the company represented. This
statement must be executed and submitted by the Bonding Company,
to the Engineer, before final payment can be certified.

GENERAL CONSTRUCTION
CONTRACT NO. ePW-121422-2

PROPOSAL

_____, 2022

Delaware County Council
Government Center Building
2nd and Orange Streets
Media, Pennsylvania 19063

Council Members:

Item No. 1. The undersigned hereby proposed for furnish all equipment, labor, tools and materials for the General Prime Contract for **SPRINKLER PIPING & FIRE PUMP MODIFICATIONS AT GOVERNMENT CENTER COMPLEX**, at the following price:

Amount Written _____

Dollar Amount (\$) _____

If the required quantities of the following items are increased or decreased by Change Order, the adjustment unit price set forth below shall apply to such increased or decreased quantities.

Unit Prices: See Section 011510

Excavation (unsuitable soil) \$ _____ per cu. yd.

Compacted fill \$ _____ per cu. yd.

Bituminous Paving (including subbase) \$ _____ per sq. yd.

Concrete Curb \$ _____ per lin. ft.

Concrete Walk (including subbase) \$ _____ per sq. ft.

Structural/Misc Steel: Fabricated, erected, coated, and painted steel (W.F. Sections, angles, frames, or miscellaneous steel) \$ _____ per ton.
Include shop drawings, fabrication & erection.

It is understood that THE INSURANCE REQUIREMENTS ARE A CRITICAL PORTION OF THIS SPECIFICATION. THE REQUIREMENTS AS SET FORTH ON PAGES IR. 1 AND IR. 2 AND SECURITY REQUIREMENTS AS SET FORTH ON PAGE GC-20, MUST BE COMPLETELY SATISFIED.

IT IS UNDERSTOOD THAT NO EXCEPTIONS WILL BE MADE.

IT IS UNDERSTOOD THAT NO EXCLSIONS OR EXCEPTIONS SHALL BE ALLOWED TO BE ATTACHED TO THIS PROPOSAL.

It is further understood that upon notice to furnish the County with the necessary Contract and Bonds, we will execute the attached Form of Contract and Bonds with the County of Delaware within twenty (20) days after receipt of such notice.

It is understood that the County Council reserves the right to reject any and all bids and that if the Successful Bidder fails to execute the attached Contract and Bond within twenty (20) calendar days after receiving notice from the County to do so, the County Council shall be free to notify the next lowest, responsible bidder. It is understood that if the Successful Bidder shall fail to execute a Contract as set forth in these General Conditions, deposit will be forfeited as liquidated damages. Award will be based on bids for the Base Bid(s) or a combination of Base Bid(s) and Alternates.

It is understood that this Bid may not be withdrawn for a period of sixty (60) days after the opening thereof.

It is understood that we will commence work within five (5) days after execution of Contract and shall complete work in accordance with the schedule given in the Special Conditions. Liquidated damages (if any) shall be assessed as defined in the Special Conditions for all days past this limit. It is understood that the County may, on its own decision or initiate, extend the completion date by giving notice of all parties to this Contract of its intention to extend.

Owner shall not be liable for any expenses, damages, loss of profits, anticipated or otherwise.

It is understood that if our Bonding Company is not a Pennsylvania Company, the Performance Bond must be countersigned by a Pennsylvania Resident Agent, with Power of Attorney so to do.

The undersigned acknowledges receipt of the following Addenda or Bulletins and that he has prepared this bid accordingly:

Addendum

Dated

Insert the number of all addenda received. In none were received, insert the word "None".

It is understood that each bidder prepare and present satisfactory evidence of this experience, qualification, and financial abilities to carry out the terms of the Contract. Also, Prime Contractor shall prepare and present satisfactory evidence of his qualification and references related to the work.

It is understood that the Proposal Page must have two (2) signatures, and if the firm is a corporation, the corporate seal must also be affixed when submitting bid.

Material Safety Data Sheets (MSDS) must be submitted for respective products before award, in compliance with the Federal Hazard Communication Standard Act (29 CFR 1910, 1200) and various State Right-to-Know laws, as applicable.

Our signature on this proposal Page signifies that we have read and agree to comply with all parts of the Invitation, Proposal, General Conditions, Special Conditions and Specifications of this Bid and will carry out all the conditions of the above.

The undersigned hereby certifies that this proposal is genuine and not a sham or collusive, or made in the interest or in behalf of any person, firm or corporation not herein named, and that the undersigned has not, directly or indirectly, induced or solicited any other bidder to submit a sham bid or any other person, firm or corporation to refrain from bidding, and the undersigned has not in any manner sought by collusion to secure for himself an advantage over any other bidder.

Respectfully submitted,

Name of Bidder

Title

ATTEST:

Secretary or Assistant Secretary

Address of Bidder

NOTES:

If the Bidder is a partnership, the names of all members of the firm, as well as the trading name, shall be set forth. If the Bidder is a corporation, the Bid must be executed by the President or Vice-President, and attested by the Secretary or Assistant Secretary of the corporation, with the corporate seal applied. No other names will be accepted unless accompanied by the proper certification from the corporation permitting other than the President or Vice-President and Secretary to sign contracts. If the business is operated by a sole Owner, only his signature is required, and it should be noted under signature that he is the sole Owner.

**GENERAL CONSTRUCTION PROPOSAL
LIST OF REQUIRED BID DOCUMENTS
SPRINKLER PIPING & FIRE PUMP MODIFICATIONS
AT GOVERNMENT CENTER COMPLEX
FOR THE COUNTY OF DELAWARE**

The following documents shall be included with a Bidders Construction Proposal. Failure to submit all documents indicated below may be cause for rejection of the Bidder's Proposal.

DOCUMENT

X

1. Form of Proposal (One original and one copy of original). Copy attached.
No exclusions or exceptions shall be allowed attached to this proposal. If so,
the Proposal shall be immediately rejected and deemed null and void.

☐

2. Bid Bond or Certified Check (10% of Bid Amount).

☐

3. Contractor Responsibility Certification (page 1 thru page 4). Copy attached.

☐

4. Written statement describing his Apprentice Training Program and
Affirmative Action Program.

☐

5. Contractor's Qualification Statement (AIA Document A305). Copy attached.

☐

6. Identification in writing of the Bidders Insurance Carrier & Bonding Company.
Failure to supply this information will result in automatic disqualification.

☐

7. Public Works Employment Verification Form.

☐

FIRE SUPPRESSION CONSTRUCTION
CONTRACT NO. ePW-121422-2

PROPOSAL

_____, 2022

Delaware County Council
Government Center Building
2nd and Orange Streets
Media, Pennsylvania 19063

Council Members:

Item No. 1. The undersigned hereby proposed for furnish all equipment, labor, tools and materials for the Plumbing Prime Contract for **SPRINKLER PIPING & FIRE PUMP MODIFICATIONS AT GOVERNMENT CENTER COMPLEX**, at the following price:

Amount Written _____

Dollar Amount (\$) _____

If the required quantities of the following items are increased or decreased by Change Order, the adjustment unit price set forth below shall apply to such increased or decreased quantities.

Unit Prices: See Section 011510

<i>Excavation (unsuitable soil)</i>	\$ _____ per cu. yd.
<i>Compacted fill</i>	\$ _____ per cu. yd.
<i>Bituminous Paving (including subbase)</i>	\$ _____ per sq. yd.
<i>Concrete Curb</i>	\$ _____ per lin. ft.
<i>Concrete Walk (including subbase)</i>	\$ _____ per sq. ft.
<i>Sprinkler Head including branch piping (approximately 10 ft.) an connection branch main</i>	\$ _____ per unit
<i>277 Volt Heating Tracing on 6" Sprinkler piping with 2" insulation</i>	\$ _____ per 10 lin. ft.
<i>Fire Protection system – Tamper Switch</i>	\$ _____ per unit
<i>Fire Protection system – Flow Switch</i>	\$ _____ per unit
<i>1/2" Type "L" copper tubing</i>	\$ _____ per lin. ft.

<i>3/4" Type "L" copper tubing</i>	<i>\$_____ per lin. ft.</i>
<i>1" Type "L" copper tubing</i>	<i>\$_____ per lin. ft.</i>
<i>1-1/2" Type "L" copper tubing</i>	<i>\$_____ per lin. ft.</i>
<i>2" Type "L" copper tubing</i>	<i>\$_____ per lin. ft.</i>
<i>2-1/2" Type "L" copper tubing</i>	<i>\$_____ per lin. ft.</i>
<i>1" black steel schedule 40 pipe</i>	<i>\$_____ per lin. ft.</i>
<i>1-1/2" black steel schedule 40 pipe</i>	<i>\$_____ per lin. ft.</i>
<i>2" black steel schedule 40 pipe</i>	<i>\$_____ per lin. ft.</i>
<i>2-1/2" black steel schedule 40 pipe</i>	<i>\$_____ per lin. ft.</i>
<i>3" black steel schedule 40 pipe</i>	<i>\$_____ per lin. ft.</i>
<i>4" black steel schedule 40 pipe</i>	<i>\$_____ per lin. ft.</i>
<i>5" black steel schedule 40 pipe</i>	<i>\$_____ per lin. ft.</i>
<i>6" black steel schedule 40 pipe</i>	<i>\$_____ per lin. ft.</i>
<i>8" black steel schedule 40 pipe</i>	<i>\$_____ per lin. ft.</i>
<i>8" C.I.C.L Underground piping</i>	<i>\$_____ per 5 ft. section</i>
<i>10" C.I.C.L Underground piping</i>	<i>\$_____ per 5 ft. section</i>
<i>Ball Valve, under 1"</i>	<i>\$_____ per unit</i>
<i>Ball Valve, 1"</i>	<i>\$_____ per unit</i>
<i>Ball Valve, 1-1/2"</i>	<i>\$_____ per unit</i>
<i>Ball Valve, 2"</i>	<i>\$_____ per unit</i>
<i>Ball Valve, 2-1/2"</i>	<i>\$_____ per unit</i>
<i>Ball Valve, 3"</i>	<i>\$_____ per unit</i>
<i>Gate Valve, 2-1/2"</i>	<i>\$_____ per unit</i>
<i>Gate Valve, 3"</i>	<i>\$_____ per unit</i>
<i>Gate Valve, 4"</i>	<i>\$_____ per unit</i>
<i>OS&Y Gate Valve, 8" with temper switch</i>	<i>\$_____ per unit</i>

OS&Y Gate Valve, 10" with temper switch

\$ _____ *per unit*

It is understood that THE INSURANCE REQUIREMENTS ARE A CRITICAL PORTION OF THIS SPECIFICATION. THE REQUIREMENTS AS SET FORTH ON PAGES IR. 1 AND IR. 2 AND SECURITY REQUIREMENTS AS SET FORTH ON PAGE GC-20, MUST BE COMPLETELY SATISFIED.

IT IS UNDERSTOOD THAT NO EXCEPTIONS WILL BE MADE.

IT IS UNDERSTOOD THAT NO EXCLSIONS OR EXCEPTIONS SHALL BE ALLOWED TO BE ATTACHED TO THIS PROPOSAL.

It is further understood that upon notice to furnish the County with the necessary Contract and Bonds, we will execute the attached Form of Contract and Bonds with the County of Delaware within twenty (20) days after receipt of such notice.

It is understood that the County Council reserves the right to reject any and all bids and that if the Successful Bidder fails to execute the attached Contract and Bond within twenty (20) calendar days after receiving notice from the County to do so, the County Council shall be free to notify the next lowest, responsible bidder. It is understood that if the Successful Bidder shall fail to execute a Contract as set forth in these General Conditions, deposit will be forfeited as liquidated damages. Award will be based on bids for the Base Bid(s) or a combination of Base Bid(s) and Alternates.

It is understood that this Bid may not be withdrawn for a period of sixty (60) days after the opening thereof.

It is understood that we will commence work within five (5) days after execution of Contract and shall complete work in accordance with the schedule given in the Special Conditions. Liquidated damages (if any) shall be assessed as defined in the Special Conditions for all days past this limit. It is understood that the County may, on its own decision or initiate, extend the completion date by giving notice of all parties to this Contract of its intention to extend.

Owner shall not be liable for any expenses, damages, loss of profits, anticipated or otherwise.

It is understood that if our Bonding Company is not a Pennsylvania Company, the Performance Bond must be countersigned by a Pennsylvania Resident Agent, with Power of Attorney so to do.

The undersigned acknowledges receipt of the following Addenda or Bulletins and that he has prepared this bid accordingly:

Addendum

Dated

Insert the number of all addenda received. In none were received, insert the word "None".

It is understood that each bidder prepare and present satisfactory evidence of this experience, qualification, and financial abilities to carry out the terms of the Contract. Also, Prime Contractor shall prepare and present satisfactory evidence of his qualification and references related to the work.

It is understood that the Proposal Page must have two (2) signatures, and if the firm is a corporation, the corporate seal must also be affixed when submitting bid.

Material Safety Data Sheets (MSDS) must be submitted for respective products before award, in compliance with the Federal Hazard Communication Standard Act (29 CFR 1910, 1200) and various State Right-to-Know laws, as applicable.

Our signature on this proposal Page signifies that we have read and agree to comply with all parts of the Invitation, Proposal, General Conditions, Special Conditions and Specifications of this Bid and will carry out all the conditions of the above.

The undersigned hereby certifies that this proposal is genuine and not a sham or collusive, or made in the interest or in behalf of any person, firm or corporation not herein named, and that the undersigned has not, directly or indirectly, induced or solicited any other bidder to submit a sham bid or any other person, firm or corporation to refrain from bidding, and the undersigned has not in any manner sought by collusion to secure for himself an advantage over any other bidder.

Respectfully submitted,

Name of Bidder

Title

ATTEST:

Secretary or Assistant Secretary

Address of Bidder

NOTES:

If the Bidder is a partnership, the names of all members of the firm, as well as the trading name, shall be set forth. If the Bidder is a corporation, the Bid must be executed by the President or Vice-President, and attested by the Secretary or Assistant Secretary of the corporation, with the corporate seal applied. No other names will be accepted unless accompanied by the proper certification from the corporation permitting other than the President or Vice-President and Secretary to sign contracts. If the business is operated by a sole Owner, only his signature is required, and it should be noted under signature that he is the sole Owner.

**FIRE SUPPRESSION CONSTRUCTION PROPOSAL
LIST OF REQUIRED BID DOCUMENTS
SPRINKLER PIPING & FIRE PUMP MODIFICATIONS
AT GOVERNMENT CENTER COMPLEX
FOR THE COUNTY OF DELAWARE**

The following documents shall be included with a Bidders Construction Proposal. Failure to submit all documents indicated below may be cause for rejection of the Bidder's Proposal.

DOCUMENT

- | <u>DOCUMENT</u> | <u>X</u> |
|--|--------------------------|
| 1. Form of Proposal (One original and one copy of original). Copy attached.
No exclusions or exceptions shall be allowed attached to this proposal. If so, the Proposal shall be immediately rejected and deemed null and void. | <input type="checkbox"/> |
| 2. Bid Bond or Certified Check (10% of Bid Amount). | <input type="checkbox"/> |
| 3. Contractor Responsibility Certification (page 1 thru page 4). Copy attached. | <input type="checkbox"/> |
| 4. Written statement describing his Apprentice Training Program and Affirmative Action Program. | <input type="checkbox"/> |
| 5. Contractor's Qualification Statement (AIA Document A305). Copy attached. | <input type="checkbox"/> |
| 6. Identification in writing of the Bidders Insurance Carrier & Bonding Company.
Failure to supply this information will result in automatic disqualification. | <input type="checkbox"/> |
| 7. Public Works Employment Verification Form. | <input type="checkbox"/> |

PLUMBING CONSTRUCTION
CONTRACT NO. ePW-121422-2

PROPOSAL

_____, 2022

Delaware County Council
Government Center Building
2nd and Orange Streets
Media, Pennsylvania 19063

Council Members:

Item No. 1. The undersigned hereby proposed for furnish all equipment, labor, tools and materials for the Plumbing Prime Contract for **SPRINKLER PIPING & FIRE PUMP MODIFICATIONS AT GOVERNMENT CENTER COMPLEX**, at the following price:

Amount Written _____

Dollar Amount (\$) _____

If the required quantities of the following items are increased or decreased by Change Order, the adjustment unit price set forth below shall apply to such increased or decreased quantities.

Unit Prices: See Section 011510

<i>Excavation (unsuitable soil)</i>	\$ _____ <i>per cu. yd.</i>
<i>Compacted fill</i>	\$ _____ <i>per cu. yd.</i>
<i>Bituminous Paving (including subbase)</i>	\$ _____ <i>per sq. yd.</i>
<i>Concrete Curb</i>	\$ _____ <i>per lin. ft.</i>
<i>Concrete Walk (including subbase)</i>	\$ _____ <i>per sq. ft.</i>
<i>2" sanitary and vent pipe above grade</i>	\$ _____ <i>per lin. ft.</i>
<i>2" sanitary and vent pipe below grade</i>	\$ _____ <i>per lin. ft.</i>
<i>3" sanitary and vent pipe below grade</i>	\$ _____ <i>per lin. ft.</i>
<i>4" sanitary and vent pipe below grade</i>	\$ _____ <i>per lin. ft.</i>
<i>2-1/2" black iron above grade natural gas piping with hangers (painted yellow)</i>	\$ _____ <i>per 8 ft. section</i>

Unit Prices (Continued):

<i>3" black iron above grade natural gas piping with hangers (painted yellow)</i>	<i>\$_____ per 8 ft. section</i>
<i>4" black iron above grade natural gas piping with hangers (painted yellow)</i>	<i>\$_____ per 8 ft. section</i>
<i>3" mechanical trap seal in floor drain</i>	<i>\$_____ per unit</i>
<i>4" mechanical trap seal in floor drain</i>	<i>\$_____ per unit</i>

It is understood that THE INSURANCE REQUIREMENTS ARE A CRITICAL PORTION OF THIS SPECIFICATION. THE REQUIREMENTS AS SET FORTH ON PAGES IR. 1 AND IR. 2 AND SECURITY REQUIREMENTS AS SET FORTH ON PAGE GC-20, MUST BE COMPLETELY SATISFIED.

IT IS UNDERSTOOD THAT NO EXCEPTIONS WILL BE MADE.

IT IS UNDERSTOOD THAT NO EXCLSIONS OR EXCEPTIONS SHALL BE ALLOWED TO BE ATTACHED TO THIS PROPOSAL.

It is further understood that upon notice to furnish the County with the necessary Contract and Bonds, we will execute the attached Form of Contract and Bonds with the County of Delaware within twenty (20) days after receipt of such notice.

It is understood that the County Council reserves the right to reject any and all bids and that if the Successful Bidder fails to execute the attached Contract and Bond within twenty (20) calendar days after receiving notice from the County to do so, the County Council shall be free to notify the next lowest, responsible bidder. It is understood that if the Successful Bidder shall fail to execute a Contract as set forth in these General Conditions, deposit will be forfeited as liquidated damages. Award will be based on bids for the Base Bid(s) or a combination of Base Bid(s) and Alternates.

It is understood that this Bid may not be withdrawn for a period of sixty (60) days after the opening thereof.

It is understood that we will commence work within five (5) days after execution of Contract and shall complete work in accordance with the schedule given in the Special Conditions. Liquidated damages (if any) shall be assessed as defined in the Special Conditions for all days past this limit. It is understood that the County may, on its own decision or initiate, extend the completion date by giving notice of all parties to this Contract of its intention to extend.

Owner shall not be liable for any expenses, damages, loss of profits, anticipated or otherwise.

It is understood that if our Bonding Company is not a Pennsylvania Company, the Performance Bond must be countersigned by a Pennsylvania Resident Agent, with Power of Attorney so to do.

The undersigned acknowledges receipt of the following Addenda or Bulletins and that he has prepared this bid accordingly:

Addendum

Dated

Insert the number of all addenda received. In none were received, insert the word "None".

It is understood that each bidder prepare and present satisfactory evidence of this experience, qualification, and financial abilities to carry out the terms of the Contract. Also, Prime Contractor shall prepare and present satisfactory evidence of his qualification and references related to the work.

It is understood that the Proposal Page must have two (2) signatures, and if the firm is a corporation, the corporate seal must also be affixed when submitting bid.

Material Safety Data Sheets (MSDS) must be submitted for respective products before award, in compliance with the Federal Hazard Communication Standard Act (29 CFR 1910, 1200) and various State Right-to-Know laws, as applicable.

Our signature on this proposal Page signifies that we have read and agree to comply with all parts of the Invitation, Proposal, General Conditions, Special Conditions and Specifications of this Bid and will carry out all the conditions of the above.

The undersigned hereby certifies that this proposal is genuine and not a sham or collusive, or made in the interest or in behalf of any person, firm or corporation not herein named, and that the undersigned has not, directly or indirectly, induced or solicited any other bidder to submit a sham bid or any other person, firm or corporation to refrain from bidding, and the undersigned has not in any manner sought by collusion to secure for himself an advantage over any other bidder.

Respectfully submitted,

Name of Bidder

Title

ATTEST:

Secretary or Assistant Secretary

Address of Bidder

NOTES:

If the Bidder is a partnership, the names of all members of the firm, as well as the trading name, shall be set forth. If the Bidder is a corporation, the Bid must be executed by the President or Vice-President, and attested by the Secretary or Assistant Secretary of the corporation, with the corporate seal applied. No other names will be accepted unless accompanied by the proper certification from the corporation permitting other than the President or Vice-President and Secretary to sign contracts. If the business is operated by a sole Owner, only his signature is required, and it should be noted under signature that he is the sole Owner.

**PLUMBING CONSTRUCTION PROPOSAL
LIST OF REQUIRED BID DOCUMENTS
SPRINKLER PIPING & FIRE PUMP MODIFICATIONS
AT GOVERNMENT CENTER COMPLEX
FOR THE COUNTY OF DELAWARE**

The following documents shall be included with a Bidders Construction Proposal. Failure to submit all documents indicated below may be cause for rejection of the Bidder's Proposal.

DOCUMENT

X

1. Form of Proposal (One original and one copy of original). Copy attached.
No exclusions or exceptions shall be allowed attached to this proposal. If so,
the Proposal shall be immediately rejected and deemed null and void.

☐

2. Bid Bond or Certified Check (10% of Bid Amount).

☐

3. Contractor Responsibility Certification (page 1 thru page 4). Copy attached.

☐

4. Written statement describing his Apprentice Training Program and
Affirmative Action Program.

☐

5. Contractor's Qualification Statement (AIA Document A305). Copy attached.

☐

6. Identification in writing of the Bidders Insurance Carrier & Bonding Company.
Failure to supply this information will result in automatic disqualification.

☐

7. Public Works Employment Verification Form.

☐

MECHANICAL CONSTRUCTION
CONTRACT NO. ePW-121422-2

PROPOSAL

_____, 2022

Delaware County Council
Government Center Building
2nd and Orange Streets
Media, Pennsylvania 19063

Council Members:

Item No. 1. The undersigned hereby proposed for furnish all equipment, labor, tools and materials for the Mechanical Prime Contract for **SPRINKLER PIPING & FIRE PUMP MODIFICATIONS AT GOVERNMENT CENTER COMPLEX**, at the following price:

Amount Written _____

Dollar Amount (\$) _____

If the required quantities of the following items are increased or decreased by Change Order, the adjustment unit price set forth below shall apply to such increased or decreased quantities.

Unit Prices : See Section 011510

<i>Galvanized steel ductwork, no liner, less than 2" static pressure</i>	\$ _____ per lb.
<i>Rigid duct insulation (1-inch thick)</i>	\$ _____ per sq. ft.
<i>4" heating hot water piping insulation</i>	\$ _____ per lin. ft.
<i>6" heating hot water piping insulation</i>	\$ _____ per lin. ft.
<i>4" chilled water piping insulation</i>	\$ _____ per lin. ft.
<i>6" chilled water piping insulation</i>	\$ _____ per lin. ft.
<i>277-volt heat tracing for 6" insulated piping with 2" mineral fiber insulation</i>	\$ _____ per lin. ft.
<i>4" condenser water piping insulation</i>	\$ _____ per ft.
<i>6" condenser water piping insulation</i>	\$ _____ per ft.
<i>Wall mounted temperature sensor, including wiring</i>	\$ _____ per unit

Unit Prices (Continued):

<i>Direct digital control system space temperature sensor including wiring (with no display and adjustment)</i>	\$ _____ <i>per unit</i>
<i>Direct digital control system damper actuator</i>	\$ _____ <i>per unit</i>
<i>Direct digital control system communication bus wiring with conduit</i>	\$ _____ <i>per lin. ft.</i>
<i>Direct digital control system programming</i>	\$ _____ <i>per unit</i>

It is understood that THE INSURANCE REQUIREMENTS ARE A CRITICAL PORTION OF THIS SPECIFICATION. THE REQUIREMENTS AS SET FORTH ON PAGES IR. 1 AND IR. 2 AND SECURITY REQUIREMENTS AS SET FORTH ON PAGE GC-20, MUST BE COMPLETELY SATISFIED.

IT IS UNDERSTOOD THAT NO EXCEPTIONS WILL BE MADE.

IT IS UNDERSTOOD THAT NO EXCLSIONS OR EXCEPTIONS SHALL BE ALLOWED TO BE ATTACHED TO THIS PROPOSAL.

It is further understood that upon notice to furnish the County with the necessary Contract and Bonds, we will execute the attached Form of Contract and Bonds with the County of Delaware within twenty (20) days after receipt of such notice.

It is understood that the County Council reserves the right to reject any and all bids and that if the Successful Bidder fails to execute the attached Contract and Bond within twenty (20) calendar days after receiving notice from the County to do so, the County Council shall be free to notify the next lowest, responsible bidder. It is understood that if the Successful Bidder shall fail to execute a Contract as set forth in these General Conditions, deposit will be forfeited as liquidated damages. Award will be based on bids for the Base Bid(s) or a combination of Base Bid(s) and Alternates.

It is understood that this Bid may not be withdrawn for a period of sixty (60) days after the opening thereof.

It is understood that we will commence work within five (5) days after execution of Contract and shall complete work in accordance with the schedule given in the Special Conditions. Liquidated damages (if any) shall be assessed as defined in the Special Conditions for all days past this limit. It is understood that the County may, on its own decision or initiate, extend the completion date by giving notice of all parties to this Contract of its intention to extend.

Owner shall not be liable for any expenses, damages, loss of profits, anticipated or otherwise.

It is understood that if our Bonding Company is not a Pennsylvania Company, the Performance Bond must be countersigned by a Pennsylvania Resident Agent, with Power of Attorney so to do.

The undersigned acknowledges receipt of the following Addenda or Bulletins and that he has prepared this bid accordingly:

Addendum

Dated

Insert the number of all addenda received. In none were received, insert the word "None".

It is understood that each bidder prepare and present satisfactory evidence of this experience, qualification, and financial abilities to carry out the terms of the Contract. Also, Prime Contractor shall prepare and present satisfactory evidence of his qualification and references related to the work.

It is understood that the Proposal Page must have two (2) signatures, and if the firm is a corporation, the corporate seal must also be affixed when submitting bid.

Material Safety Data Sheets (MSDS) must be submitted for respective products before award, in compliance with the Federal Hazard Communication Standard Act (29 CFR 1910, 1200) and various State Right-to-Know laws, as applicable.

Our signature on this proposal Page signifies that we have read and agree to comply with all parts of the Invitation, Proposal, General Conditions, Special Conditions and Specifications of this Bid and will carry out all the conditions of the above.

The undersigned hereby certifies that this proposal is genuine and not a sham or collusive, or made in the interest or in behalf of any person, firm or corporation not herein named, and that the undersigned has not, directly or indirectly, induced or solicited any other bidder to submit a sham bid or any other person, firm or corporation to refrain from bidding, and the undersigned has not in any manner sought by collusion to secure for himself an advantage over any other bidder.

Respectfully submitted,

Name of Bidder

Title

ATTEST:

Secretary or Assistant Secretary

Address of Bidder

NOTES:

If the Bidder is a partnership, the names of all members of the firm, as well as the trading name, shall be set forth. If the Bidder is a corporation, the Bid must be executed by the President or Vice-President, and attested by the Secretary or Assistant Secretary of the corporation, with the corporate seal applied. No other names will be accepted unless accompanied by the proper certification from the corporation permitting other than the President or Vice-President and Secretary to sign contracts. If the business is operated by a sole Owner, only his signature is required, and it should be noted under signature that he is the sole Owner.

**MECHANICAL CONSTRUCTION PROPOSAL
LIST OF REQUIRED BID DOCUMENTS
SPRINKLER PIPING & FIRE PUMP MODIFICATIONS
AT GOVERNMENT CENTER COMPLEX
FOR THE COUNTY OF DELAWARE**

The following documents shall be included with a Bidders Construction Proposal. Failure to submit all documents indicated below may be cause for rejection of the Bidder's Proposal.

DOCUMENT

X

1. Form of Proposal (One original and one copy of original). Copy attached.
No exclusions or exceptions shall be allowed attached to this proposal. If so,
the Proposal shall be immediately rejected and deemed null and void.

☐

2. Bid Bond or Certified Check (10% of Bid Amount).

☐

3. Contractor Responsibility Certification (page 1 thru page 4). Copy attached.

☐

4. Written statement describing his Apprentice Training Program and
Affirmative Action Program.

☐

5. Contractor's Qualification Statement (AIA Document A305). Copy attached.

☐

6. Identification in writing of the Bidders Insurance Carrier & Bonding Company.
Failure to supply this information will result in automatic disqualification.

☐

7. Public Works Employment Verification Form.

☐

ELECTRICAL CONSTRUCTION
CONTRACT NO. ePW-121422-2

PROPOSAL

_____, 2022

Delaware County Council
Government Center Building
2nd and Orange Streets
Media, Pennsylvania 19063

Council Members:

Item No. 1. The undersigned hereby proposed for furnish all equipment, labor, tools and materials for the Electrical Prime Contract for **SPRINKLER PIPING & FIRE PUMP MODIFICATIONS AT GOVERNMENT CENTER COMPLEX**, at the following price:

Amount Written _____

Dollar Amount (\$) _____

If the required quantities of the following items are increased or decreased by Change Order, the adjustment unit price set forth below shall apply to such increased or decreased quantities.

Unit Prices: See Section 011510

Power outlet (duplex or quadraplex), including outlet boxes and wiring. Receptacles will generally be connected within 10' of adjacent receptacle circuits, at locations as directed by Professional	\$_____ per unit
Exterior weatherproof duplex power receptacle including up to 100 feet of (2)#12, (1)#12G, in 3/4" conduit	\$_____ per unit
Fire Alarm System - Smoke Detector Device, including outlet box and wiring	\$_____ per unit
Fire Alarm System - Heat Detector Device, including outlet box and wiring	\$_____ per unit
Fire Alarm System – Tamper Switch interface device	\$_____ per unit
Fire Alarm System – Flow Switch interface device	\$_____ per unit
Fire Alarm system wiring	\$_____ per lin. ft.
Fire Alarm system programming	\$_____ per point
Temporary removal, support & re-installation of 2'x4' light fixture including wiring.	\$_____ per unit

It is understood that THE INSURANCE REQUIREMENTS ARE A CRITICAL PORTION OF THIS SPECIFICATION. THE REQUIREMENTS AS SET FORTH ON PAGES IR. 1 AND IR. 2 AND SECURITY REQUIREMENTS AS SET FORTH ON PAGE GC-20, MUST BE COMPLETELY SATISFIED.

IT IS UNDERSTOOD THAT NO EXCEPTIONS WILL BE MADE.

IT IS UNDERSTOOD THAT NO EXCLSIONS OR EXCEPTIONS SHALL BE ALLOWED TO BE ATTACHED TO THIS PROPOSAL.

It is further understood that upon notice to furnish the County with the necessary Contract and Bonds, we will execute the attached Form of Contract and Bonds with the County of Delaware within twenty (20) days after receipt of such notice.

It is understood that the County Council reserves the right to reject any and all bids and that if the Successful Bidder fails to execute the attached Contract and Bond within twenty (20) calendar days after receiving notice from the County to do so, the County Council shall be free to notify the next lowest, responsible bidder. It is understood that if the Successful Bidder shall fail to execute a Contract as set forth in these General Conditions, deposit will be forfeited as liquidated damages. Award will be based on bids for the Base Bid(s) or a combination of Base Bid(s) and Alternates.

It is understood that this Bid may not be withdrawn for a period of sixty (60) days after the opening thereof.

It is understood that we will commence work within five (5) days after execution of Contract and shall complete work in accordance with the schedule given in the Special Conditions. Liquidated damages (if any) shall be assessed as defined in the Special Conditions for all days past this limit. It is understood that the County may, on its own decision or initiate, extend the completion date by giving notice of all parties to this Contract of its intention to extend.

Owner shall not be liable for any expenses, damages, loss of profits, anticipated or otherwise.

It is understood that if our Bonding Company is not a Pennsylvania Company, the Performance Bond must be countersigned by a Pennsylvania Resident Agent, with Power of Attorney so to do.

The undersigned acknowledges receipt of the following Addenda or Bulletins and that he has prepared this bid accordingly:

Addendum

Dated

Insert the number of all addenda received. In none were received, insert the word "None".

It is understood that each bidder prepare and present satisfactory evidence of this experience, qualification, and financial abilities to carry out the terms of the Contract. Also, Prime Contractor shall prepare and present satisfactory evidence of his qualification and references related to the work.

It is understood that the Proposal Page must have two (2) signatures, and if the firm is a corporation, the corporate seal must also be affixed when submitting bid.

Material Safety Data Sheets (MSDS) must be submitted for respective products before award, in compliance with the Federal Hazard Communication Standard Act (29 CFR 1910, 1200) and various State Right-to-Know laws, as applicable.

Our signature on this proposal Page signifies that we have read and agree to comply with all parts of the Invitation, Proposal, General Conditions, Special Conditions and Specifications of this Bid and will carry out all the conditions of the above.

The undersigned hereby certifies that this proposal is genuine and not a sham or collusive, or made in the interest or in behalf of any person, firm or corporation not herein named, and that the undersigned has not, directly or indirectly, induced or solicited any other bidder to submit a sham bid or any other person, firm or corporation to refrain from bidding, and the undersigned has not in any manner sought by collusion to secure for himself an advantage over any other bidder.

Respectfully submitted,

Name of Bidder

Title

ATTEST:

Secretary or Assistant Secretary

Address of Bidder

NOTES:

If the Bidder is a partnership, the names of all members of the firm, as well as the trading name, shall be set forth. If the Bidder is a corporation, the Bid must be executed by the President or Vice-President, and attested by the Secretary or Assistant Secretary of the corporation, with the corporate seal applied. No other names will be accepted unless accompanied by the proper certification from the corporation permitting other than the President or Vice-President and Secretary to sign contracts. If the business is operated by a sole Owner, only his signature is required, and it should be noted under signature that he is the sole Owner.

**ELECTRICAL CONSTRUCTION PROPOSAL
LIST OF REQUIRED BID DOCUMENTS
SPRINKLER PIPING & FIRE PUMP MODIFICATIONS
AT GOVERNMENT CENTER COMPLEX
FOR THE COUNTY OF DELAWARE**

The following documents shall be included with a Bidders Construction Proposal. Failure to submit all documents indicated below may be cause for rejection of the Bidder's Proposal.

DOCUMENT

X

1. Form of Proposal (One original and one copy of original). Copy attached.
No exclusions or exceptions shall be allowed attached to this proposal. If so,
the Proposal shall be immediately rejected and deemed null and void.

☐

2. Bid Bond or Certified Check (10% of Bid Amount).

☐

3. Contractor Responsibility Certification (page 1 thru page 4). Copy attached.

☐

4. Written statement describing his Apprentice Training Program and
Affirmative Action Program.

☐

5. Contractor's Qualification Statement (AIA Document A305). Copy attached.

☐

6. Identification in writing of the Bidders Insurance Carrier & Bonding Company.
Failure to supply this information will result in automatic disqualification.

☐

7. Public Works Employment Verification Form.

☐

GENERAL CONDITIONS

These General Conditions shall apply to the Contract as a whole, and to each and all branches or sub-divisions and contractors for same, should the work be divided. Approved sub-contractors should be supplied with a copy of these General Conditions and no Contract or arrangements with them shall be such as to conflict herewith.

1. DEFINITIONS

The following terms shall have the meanings indicated below:

- a. The CONTRACT DOCUMENTS consist of the Agreement, the Instructions to Bidders, the General Conditions, the Proposal, the Drawings and Specifications, including all modifications thereof incorporated in the Documents before their execution.
- b. The term OWNER shall mean the County of Delaware.
- c. The term OFFICERS OF OWNER shall mean the County Council of the County of Delaware.
- d. The term ENGINEER shall mean the Design Professional who has prepared these Specifications.
- e. The term CONTRACTOR shall mean the person, firm, or corporation named in the Agreement, who will execute the work.
- f. The term SUB-CONTRACTOR includes only those having a direct Contract with a Prime Contractor for the performance of the work required under the Prime Contract, and it includes one who furnished materials worked to a special design according to the Drawings or Specifications for this work, but does not include one who merely furnishes material not so worked.
- g. Throughout the Contract Documents, the term OWNER, ENGINEER, CONTRACTOR, and SUB-CONTRACTOR are treated as if each were of the singular number.
- h. The term WORK of the Contractor or Sub-contractor includes labor, materials, and services, or any of them.
- i. Where AS SHOWN, AS DETAILED, or words of similar import are used, it shall be understood that reference to the Drawings accompanying this specification is made, unless otherwise stated.
- j. Where AS DIRECTED, AS REQUIRED, AS PERMITTED, APPROVED, ACCEPTANCE or words of similar import are used, it shall be understood that the directions, requirements, permission, approval, or acceptance of the Owner is intended, unless otherwise stated.

- k. As used herein, PROVIDED should be understood to mean PROVIDED COMPLETE IN PLACE, that is, FURNISHED AND INSTALLED.
- l. CHANGE ORDER shall mean any changes in the work which alter the terms of conditions of the Contract, including, but not limited to, any extension of time for completion of the Contract or any additional to, or deduction from the Contract Sum for extra work or changes in the work. Change orders shall be processed on standard A.I.A. forms and shall be signed by the Owner and the Contractor prior to the start of any work affected by or included in the scope of the change.
- m. The term NOTICE, as used herein, shall mean and include all written notices, demands, instructions, claims, approvals, and disapprovals required to obtain compliance with Contract requirements. Written notice by either party to the contract shall be deemed to have been duly served if delivered to or at the last known business address of the person, firm, or corporation, the other party to the Contract, or to his, their, or its duly authorized Agent, representative or Officer, or when enclosed in a postage repaid envelope addressed to such last known business address and deposited in the United States mail.
- n. The words TIME OF COMPLETION, CONTRACT TIME, or similar shall be as indicated in the Contract Documents.
- o. The law of the place of building shall govern the construction of this Contract.

2. ENGINEER'S INSPECTION

All work shall be subject to Engineer's inspection; he shall make all decisions regarding the work; shall interpret the contract documents and any authorized alterations in work; shall confirm in writing any oral orders, may stop work when necessary; have no authority to approve or order changes in work.

3. ENGINEER'S DECISION

All questions or disputes arising respecting any matter pertaining to the Contract or any part of it, or any breach of the Contract, or any questions and disagreements between the Owner and Contractor relating to the Meaning of the Drawings and Specifications or to kind and quality of work or materials required thereby, shall be decided by the Engineer. Reference of questions under this provision must be presented prior to the final payment.

4. INTENT OF CONTRACT DOCUMENTS

The Contract Documents are complementary. What is called for by any one of them, shall be as binding as if called for by all. The intention of the Contract Documents is

to include the Contract Price, the cost of all labor and materials, scaffold, ladders, runs centering, shoring, staging, rigging, hoists, water, fuel, tools, plant equipment, lights, power, transportation, shop drawings, samples, tests, tools, warranties, taxes, insurance and all other service and expenses necessary for and incidental to the proper execution and completion of the work, unless distinctly specified otherwise. In interpreting the Contract Documents, words describing materials or work which have a well-known technical or trade meaning, unless otherwise specifically defined in the Contract Documents, shall be construed in accordance with such well-known meaning, recognized by Architects, Engineers and Trades.

The Specifications, Drawings, Conditions, and Instruction in Directions as set forth are intended to cooperate and agree, and they shall be interpreted so that the work exhibited in the Drawings and not mentioned in the Specifications, or vice versa, shall be included the same as if it were mentioned in the Specifications and set forth in the Drawing themselves. Any such discrepancies shall be interpreted, explained and decided by the Engineer, who shall have the right to correct any errors or omissions in them as are necessary for the proper fulfillment of their intentions, either before or during the prosecution of the work, and the Contractor shall conform to and abide by whatever supplementary Drawings and explanations may be furnished by the Engineer for the purpose of illustrating the work.

Where the work is shown in complete detail on only half or a portion of a Drawing or there is indication of continuation, the remainder being shown in outline, the work drawn out in detail shall be understood to apply to other portions of the structure. On all work of additions, or alterations, it shall be the responsibility of the Contractor, by personal inspection, to satisfy himself as to correctness of any information given which may affect the quantity, size and quality of material required for a satisfactorily completed Contract, whether or not such information is indicated on the Drawings or within the Specifications.

5. WORK IMPLIED

Should any incidental work or materials be required but not set forth in the Specifications and Drawings, either directly or indirectly, but which is nevertheless necessary for the proper carrying out of the intent thereof, it shall be deemed to be implied and required, and the Contractor shall furnish and install all such work and materials as fully as if they were particularly delineated and described, without additional cost to the owner.

6. ACTUAL MEASUREMENTS

In all Cases where dimensions are governed by conditions already established, the Contractor must depend entirely upon measurements taken by himself, scale or

figured dimensions to the contrary notwithstanding, but no deviation from the specified dimensions shall be made unless duly authorized by the Engineer.

7. ERRORS AND DISCREPANCIES

If the Contractor, in the course of the work, finds any discrepancy between the Drawings or Specifications and the physical conditions of the premises, or any errors, in the Drawings or Specifications or in the layout as given by the points and instructions, it shall be his duty to immediately inform the Engineer, in writing. Should any work be undertaken after the discrepancy has been noted and prior to decision by the Engineer, it is understood that the Contractor will rectify, at his own expense, such work as may have been accomplished and which does not comply with the decision of the Engineer.

8. ASSUMPTION OF RISK

The Contractor represents that he has had an opportunity to examine, and has carefully examined all of the Specifications, Drawings, Instruction and Directions in connection with the work; that he has fully acquainted himself with the actual levels, the excavations and filling required, visible obstructions or known obstructions below the surface, and all other conditions relevant to the work, the site of the work and its surroundings; and is fully aware of any variances between the actual conditions relevant to the work and the same as shown or represented in said Specifications, Drawings and Directions, as far as such variances can be determined by an inspection of the site; that he has made all investigations essential to a full understanding of the difficulties which may be encountered in performing the work and that anything in any of said Documents or in any representation, statements, or information made or furnished by Owner or Engineer notwithstanding, the Contractor will, regardless of any such conditions relevant to the work, the site of the work or its surroundings, complete the work for the compensation agreed upon (except in the case of changes in the work made by the Owner or Engineer and conditions at the site that cannot be determined by inspection, in connection with which the Contractor will be paid as provided in the Article regarding Changes), and will assume full and complete responsibility therefore and all risk in connection therewith. In addition, thereto, the Contractor represents that he has special qualifications for doing the work and will complete the said work to the satisfaction of Owner and Engineer.

9. SIGNING OF DOCUMENTS

The Contract Documents shall be signed, in duplicate, by the Owner and the Contractor.

10. ASSIGNMENT OF CONTRACT

The Contractor shall not assign the Contract or any part thereof without the written consent of the County of Delaware. He shall not Sub-Contract without prior written approval from the County of Delaware.

11. SUB-CONTRACTS

As soon as practicable and before awarding any sub-contracts, the Contractor shall notify the Engineer and Owner in writing, of the names of the sub-contractors proposed for the principal parts of the work, and for such other parts as the Engineer or Owner may direct.

The Contractor shall not sublet or sub-contract any work to be performed, or any materials to be furnished in the performance of the contract without the written consent of the Engineer or Owner.

The Contractor shall not be required to employ any sub-contractor against whom he has a reasonable objection.

If the Contractor shall sublet or sub-contract any part of the Contract, the Contractor shall be as fully responsible to the Owner of the acts and omissions of his sub-contractor as he is for the acts and omissions of persons directly employed by himself. The Engineer shall, on request, furnish to any sub-contractor, whatever practicable, evidence of the amounts certified on his account.

Nothing contained in the Contract Documents shall create any contractual relationship between any sub-contractor and the Owner. The Contractor agrees to bind every sub-contractor and every subcontractor shall agree to be bound by the terms of the Instructions to Bidders, Special Conditions, General Conditions, Drawings and Specification as far as applicable to his work.

12. OTHER CONTRACTS

The Owner reserves the right to let other Contracts in connection with this work even if of like character to the work under this Contract. The Contractor shall afford other Contractors adequate opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with their work.

If any part of the Contractor's work depends for proper execution or results upon the work of any other Contractor, the Contractor shall inspect and promptly report to the Engineer and Owner, any defects in such work that render it unsuitable for such proper acceptance of the other Contractor's work as fit and proper acceptance of the

Contractor's work as fit and proper for the reception of his work, except as to defects which may develop in the other Contractor's work after the execution of subsequent work.

To ensure the proper execution of this subsequent work, the Contractor shall measure work already in place and shall at once report to the Engineer any discrepancy between the executed work and the drawings.

13. TAXES

All Federal, State and Local Taxes, including Excise Tax, Sales and Use Taxes, when applicable, shall be included in the Proposal, and shall be paid by the Contractor.

14. OWNER'S RIGHT TO OCCUPY

The Owner reserves the right to occupy any portion of the project, before it has been entirely completed, with the distinct understanding that such occupancy shall in no way constitute acceptance of the work in whole or any part thereof, or of any work performed under the Contract.

The Contractor will be held strictly to the terms of the Contract regarding the diligent prosecution of the work and the time of completion of same. In case additional work is ordered or in case of delays not the fault of the Contractor, the Owner may make an equitable extension of working time by so designating in writing.

15. DEFAULT ON PART OF CONTRACTOR

If the Engineer shall at any time be of the opinion that the Contractor is not progressing with the work as rapidly as necessary to insure its completion by the date set forth in the Contract or is neglecting to remedy any imperfections or to repair damage to public or private property; or continues to employ or re-employ negligent or careless persons; or is conducting the work in a manner disapproved by the Engineer or if the Contractor stops or abandons work on any part of the construction without the written consent of the Engineer, or is violating any of the provisions of the Contract, the Engineer shall give the Contractor written notice of the specific deficiencies and direct the Contractor to remedy same. If, at the end of seven (7) calendar days from the date of such notice, the Contractor shall have failed to comply therewith, then the Owner may withhold all payments until the provisions of such notice are carried out and may also place additional forces, equipment, tools and materials on parts of the work at the Contractor's expense as specified or it may annul the Contract.

In case the Owner should augment the Contractor's forces, equipment, etc., as herein provided, the cost incurred in carrying on such parts of the work shall be paid by the Contractor. The Owner may retain the amount of the cost of such work from any sum

or sums due or to become due the Contractor under this Contract. If such costs exceed such unpaid balance, the Contractor shall pay the difference to the Owner.

Should the Contractor be judged as bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he files any proceedings under the provisions of the Bankruptcy Act, or if he should persistently or repeatedly refuse, or should fail, except in cases for which extension of time is provided to supply enough properly skilled workmen or proper materials, or if he should fail to make prompt payment to sub-contractors or for material or labor, or persistently disregard laws, ordinances or the instruction of the Engineer or otherwise be guilty of a substantial violation of any provision of the Contract, then the Owner, upon the Certificate of the Engineer that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy and after giving the Contractor, and his Surety, if any, seven (7) calendar days written notice, terminate the employment of the Contractor and take possession of the premises by whatever method he may deem expedient, including, but not limited to, contracting with another Contractor. The Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the Contract price shall exceed the expense of finishing the work, including compensation for additional engineering, managerial and administrative services, such balance shall be paid to the Contractor; should the unpaid balance be insufficient to complete the work, including compensation for engineering, managerial and administrative services, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner as herein provided, and the damage incurred through the Contractor's default, shall be certified by the Engineer.

16. REMOVAL OF EQUIPMENT

No equipment shall be removed from the worksite by the Contractor, except as herein designated until the usefulness of such equipment on the worksite has ceased, or except with the written consent of the Engineer, otherwise such removal may be considered by the Owner as an abandonment on the part of the Contractor.

In the case of annulment or rescission, or termination of this Contract for any cause whatsoever before the completion of this Project, no equipment, material or supplies shall be removed from the site without the prior authorization in writing from the Owner. Upon written notice from the Engineer to do so, the Contractor shall promptly remove such equipment and supplies from the property of the Owner. The Contractor's failure to carry out the provisions of such notice shall give the right to the Owner to remove such equipment and supplies at the expense of the Contractor.

17. MATERIALS AND WORKMANSHIP

Unless otherwise specifically stipulated in the Specifications, all workmanship shall be of the best quality and all equipment, materials and articles incorporated in the work under the Contract shall be new and of the best grade of their respective kinds for the purpose. The Contractor shall, if required, furnish evidence as to kind and quality of materials.

Should any dispute arise as to the quality and fitness of workmanship, equipment, materials and articles, the decision shall rest strictly with the Engineer and shall be based upon the requirements of the Contract, and what is usual and customary in the execution of other work shall in no way enter any consideration or decision whatsoever.

Where equipment, materials or articles are referred to in the Specifications as equal to any particular standard, the Engineer shall decide the question of quality. The Contractor shall furnish to the Engineer for his approval, the name of the manufacturer of machinery, mechanical and other equipment that he contemplates incorporating in the work, together with their performance, capacities and other pertinent information.

Where required by the Specifications or when called for by the Engineer, the Contractor shall furnish the Engineer for approval, full information concerning the materials or articles that he contemplates incorporating in the work. Machinery, equipment, materials and articles installed or used without such approval shall be at the risk of subsequent rejection.

When the Specifications give the Contractor the option of using one of several definitely named makes or kinds of a particular item or "Approved" equal, the Contractor shall use one of the named items or submit a written request to the Engineer for approval and obtain his approval of an equal before purchasing such material.

Where the Specifications call for any stipulated items, "or equal thereto and approved" or other words to that effect, the Engineer shall be the sole judge of the equality of any article or material offered and reserves the right to demand the particular items stipulated.

18. CHANGES IN SPECIFICATIONS

The Owner reserves the right to make any change in the location of any piece of apparatus or equipment, or roughing-in dimensions up to the time of roughing-in and to make any changes in the Drawings and Specifications, should any be found desirable previous to commencing or during the progress of the work, without in any

other respect or particular invalidating the original provisions of the Contract, without additional expense to the Owner unless such changes require additional labor and/or material. If such a change requires a less amount of labor and/or material than the original work shown or specified, the Owner will be entitled to a credit equal to the difference of the cost and installation. The greater or lesser amount, if any, to be paid the Contractor by the Owner by reason of such changes, shall be as herein specified or as agreed upon between them.

No part of the work shall be altered from that shown on the Drawings or described in the Specifications, nor shall any work in the nature of additional work, or any work not contemplated by the Contract Documents be performed except on written order of the Engineer, approved by the Owner, and if any extra, additional or different work be proceeded with or executed by the Contractor without previous order given, in writing, under the hand of the Engineer, as herein provided, the Contractor shall not be entitled to charge for such extra work.

19. ADDITIONAL OR OMITTED WORK

It is understood that the Owner shall have the right during the progress of construction to make any alterations, additions or omissions of work or material herein specified or shown on the Drawings that may be desired and the same shall be carried into effect by the Contractor without in any way violating the Contract. The amount of money to be added or deducted shall be agreed to, in writing, signed by the two contracting parties before any changes in the Contract Documents will be in force.

Unless specifically directed otherwise by the Engineer, the Contractor shall promptly submit his itemized prices for additions, alterations or deductions prior to proceeding with the changes, which prices, if approved by the Owner, shall be added to or deducted from the Contract price.

When so directed, the Contractor shall submit separate unit prices on work for both additions to and deductions from the Contract price; adjustment, if any, in the amounts to be paid to the Contractor by reason of any change, addition or reduction shall be determined by one or more of the following methods:

1. By unit price contained in the Contractor's Proposal and incorporated in the Contract which unit prices include all charges.
2. By an acceptable lump sum Proposal from the Contractor. Such Proposal shall indicate costs for materials and labor and shall indicate overhead and profit.

3. By actual time and material costs, verified by the Owner's representative, to which it is agreed that an overhead charge of 10% and a profit of 10% will be added.
4. No extra work or change shall be made unless in pursuance of a written order from the Owner signed or countersigned by the Engineer.

20. SUPERVISION AND LABOR

The Contractor shall provide continuous supervision of all work embraced in the Contract, from the beginning of the work to the date of final completion, by a duly authorized and competent Superintendent who shall be acceptable to the Engineer. The Superintendent shall be at all times in charge of the work and shall be provided with such assistants as are necessary to properly carry on the individual branches of the work. The Superintendent shall represent the Contractor in his absence from the work, and all directions, instruction, or notices given to the Superintendent by the Engineer shall be as binding as if given to the Contractor.

The Contractor shall at all times enforce good order and conduct among his employees. Every employee shall be a first-class workman and competent to perform the work assigned to him. Employees shall not be permitted to trespass or conduct themselves contrary to the rules and regulations governing the Owner's premises. Any employee of the Contractor whom the Engineer considers to be detrimental to the proper carrying out of the work is to be removed promptly on the request of the Engineer, and the services of such person shall not be employed on the project site without the written consent of the Engineer.

21. ENGINEERING AND LAYOUTS

If applicable, the Contractor shall provide competent engineering and layout services, approved by the Engineer, from the beginning of the work to the date of final completion of the Contract, to execute the work in accordance with the Contract requirements.

22. RIGHTS OF VARIOUS INTERESTS

Wherever work is being done by workmen other than those employed by the Contractor, but contiguous to his work, the respective rights of the parties involved shall, if necessary, be established by the Engineer. Requests in writing for such determination shall be submitted in a timely manner by the Contractor.

23. INSPECTION OF WORK

The Contractor shall afford the Engineer every facility for observation. All materials and workmanship shall be, at all times, subject to the inspection and acceptance of the Engineer who shall have full power at any time during the progress of the work to reject any materials or workmanship which the Engineer may deem unsuitable for the purpose for which they are intended, or which are not in strict conformity with the Specifications. The Engineer shall also have the power to cause any inferior or unsafe work to be taken down and altered at the cost of the Contractor. When deemed necessary for the proper protection of materials or building, the materials must be sorted and handled as directed by the Engineer. Every part of the work shall be executed to the entire satisfaction and acceptance of the Engineer and Owner.

24. WORK MAY BE PULLED DOWN AND OPENED UP FOR EXAMINATION AND INSPECTION

If directed by the Owner and the Engineer, the Contractor shall pull down, undo or uncover any part of completed or partially completed work or make openings therein to enable the Engineer to make a proper and thorough inspection and the Contractor, after such inspection, shall repair or reconstruct such affected work to the satisfaction of the Engineer.

If, in the opinion of the Engineer, the work should be found unsatisfactory in any respect, the cost of exposing, removing, replacement and restoring it shall be defrayed by the Contractor.

Should the work thus exposed be found not faulty by the Engineer, and if adequate opportunity was afforded for inspection of the work before it was covered or completed, the cost and expense thereby incurred shall be defrayed by the Owner or the Engineer to the extent to which they mutually accept responsibility for such required corrective work.

25. ROYALTIES AND PATENTS

The Contractor shall obtain all necessary consents and shall pay all royalties, licenses, and fees for the use of any patented invention, article, composition or process in the work done or the materials furnished, or any part thereof embraced in this Contract. The Contractor guarantees to save harmless the Owner, its Officers, members, Agents and employees from the liability of any kind of nature including cost and expense on account of suits and claims of any kind for the violation or infringement of any such patent rights by the Contractor or by anyone directly or indirectly employed by him, for, by reason of the use of any art, process, method, manufacture, or

composition of matter patented or un-patented in the performance of this Contract, in violation or infringement of any such patented rights.

The Contractor shall pay for all royalties, claims, and fees for any patented invention, article, or arrangements that may be used in the work under Agreement.

26. PERMITS, LICENSES AND CERTIFICATES

The Contractor shall arrange for the issuance of all Local permits required both temporary and permanent and the Contractor shall include in his price the cost of any of these items. All other licenses, certificates, inspections, survey and/or inspection fees shall be paid by the Contractor including license to practice his trade.

The Contractor shall deliver to the Engineer certificates of inspection and certificate of occupancy where such are required.

The Contractor shall furnish to the local authorities all necessary bonds or cash deposits required as a pledge and security for the protection or maintenance of any public property.

The Contractor and each of his sub-contractors shall secure and pay for all inspections and certification of their work as required by laws and regulations in effect in the locality in which the project is built including those of the Underwriter's and other regulatory bodies.

27. BUILDING REGULATIONS

The requirements of all applicable laws, rules and regulations of Local and State Departments governing building construction and equipment, shall be followed, and all work shall be carried out in strict accordance with such requirements even though each item involved be not herein particularly mentioned or shown on the drawings.

Work required by the Drawings and Specifications above or in excess of the standards required by the above-mentioned laws and regulations shall be provided as specified.

If the Drawings and Specifications are at variance with the above-mentioned laws and regulations, the Contractor shall promptly notify the Engineer, in writing, and any necessary changes shall be made as provided in the Contract. If the Contractor performs any work contrary to such laws, rules and regulations, and without such notice to the Engineer, he shall bear all costs arising therefrom.

28. COOPERATION

The Contractor shall cooperate with the other Contractors on the work and with the Owner so that the completion of all portions of the work may proceed with all possible speed. The Contractor will be required to furnish any and all other Contractors, whose work is fitted to his, detail and erection Drawings giving full information regarding the fabrication and assembly of his work.

So far as possible, these drawings shall show checked field measurements. The Contractor shall further cooperate in timing his work to join with the work of the Contractors or the Owner.

29. MOVING MATERIALS

If it becomes necessary at any time during the execution of the work to move materials or equipment which have been temporarily placed, the Contractor or Sub-contractor furnishing said materials shall, when so directed by the Engineer, move them or cause them to be moved without additional charge.

30. RECEIVING MATERIAL FURNISHED BY OTHERS

Whenever the Contractor or any Sub-contractor shall receive items from another Contractor or the Owner for storage, erection or installations, the Contractor or Sub-contractor receiving such items shall give receipt for the items delivered, and thereafter will be held responsible for the care, storage and any necessary replacing of items received.

31. INJURY TO PROPERTY

Should any direct or indirect injury be done to any existing installation or structures, or to public or private property of any kind or to any structure, materials, or fixtures, resulting from any act or omission on the part of the Contractor, his Sub-contractor, Employees or Agents, the Contractor shall, at his own expense, restore the same equal to its condition before the said damage or injury was done by repairing, replacing, rebuilding or otherwise as may be required by the Owner, Engineer or the Owner of the damaged property.

The Contractor shall take all necessary precautions to avoid injury or damage to buildings, driveways, sidewalks, grading, pipes, conduits, etc., and shall, unless otherwise specified, restore such structures, property, materials, etc., at his own cost and expense to a condition equal to that existing before such damage was done, by repairing, rebuilding, or otherwise, as may be required by the Owner, or shall make good such injury or damage in a satisfactory manner.

The Contractor shall be responsible for any injury or damage to the property of the Owner or to the property of any Public Utility Company included in this contract by or on account of any act, omission, neglect or misconduct of the Contractor in the prosecution of the work or in the storage of materials and equipment.

The Contractor shall properly safeguard the work under this Agreement and shall make good at his own expense all injuries or damages to said work before its completion and final acceptance.

32. BONDS

Should any surety upon the bonds for the performance of the Contract and payment for materials and labor become unsatisfactory to the Owner, the Contractor shall promptly furnish such additional security as may be required from time to time to protect the interest of the Owner and of persons supplying materials and labor in the prosecution of the work required by the Contract, including any change therein.

33. CUTTING AND PATCHING

The General Contractor shall do all demolition, cutting, patching, removals, additions, adjustments and replacements of building construction and finishes necessary for the installation of work of mechanical, electrical and other separate Contractors. All work shall be performed so as to leave the buildings and structures complete and watertight and, in a condition, satisfactory to the Engineer.

The Contractor for Mechanical and Electrical construction shall furnish all labor, material and equipment and perform all operations for the demolition, removal, salvaging, disposition of materials and alterations to the installations and equipment, utilities and services of their respective trades. Any cost of cutting and fittings caused by defective or ill-timed work shall be borne by the party responsible, therefore.

The Contractor shall not endanger any work by cutting, fitting or otherwise. The Contractor shall not cut or alter the work of any other Contractor.

34. ORDER OF COMPLETION

The Contractor shall complete any portion or portions of the work in such order as may be stated in the Specifications. All work shall be so arranged, and Contractors shall so coordinate their work as to complete the work by the date as set forth in the Contract.

35. SUSPENSION OF WORK DUE TO UNFAVORABLE CONDITIONS

If, in the judgment of the Engineer, the Contractor is taking undue risk in the interruption of ongoing site operations and risk of damage to any part of the building by proceeding with the work during unfavorable weather or other conditions, the Engineer shall immediately verbally notify the Contractor or his representative on the site, confirming the same in writing, with copies to the Owner. The Owner may thereupon suspend the work temporarily either wholly or in part, for such period or periods as it may be necessary on account of unsuitable weather or other conditions unfavorable for the safe and proper prosecution of the work. In case of such suspension, no allowance will be made to the Contractor for any expense resulting therefrom. The Owner shall not be liable to the Contractor in any manner for any other charges whatsoever arising out of a suspension in the work of either this Contractor or any Contractor engaged on this Project. It shall be clearly understood that the failure of the Owner or Engineer to suspend the work shall not relieve the Contractor of his responsibility for compliance with the conditions of the Contract.

36. SUSPENSION OF WORK DUE TO FAULT OF CONTRACTOR

Should the Contractor fail to comply with any order of the Engineer relative to any particular part of the work, the Engineer shall have the right to suspend the work on any or all parts until his orders respecting the particular parts are complied with. In case of such suspension, which shall be considered due to the fault of the Contractor, it shall be at the expense of the Contractor on account of idle equipment or forces during the terms of such suspension.

37. SUSPENSION OF WORK DUE TO UNFORESEEN CAUSES

If the Contractor shall be delayed in the completion of his work by reason of unforeseeable causes beyond his control and without his fault or knowledge; such as acts of God or of a public enemy, fire, flood, epidemic, quarantine, restriction, strike, riot, civil commotion or freight embargo, the period may be extended as hereinafter provided. Suspension of work as outlined above shall not in themselves operate to extend the Contract date of completion.

38. REQUEST FOR EXTENSION

The request for extension of time shall be submitted by the Contractor to the Owner and the Engineer setting forth his reasons, therefore. In submitting such requests, the Contractor shall state the completion date as stated in the existing Contract, any changes that have been authorized, and the date he is now requesting as a new completion date. The Owner will grant or deny such request at such time as he deems proper.

The Owner shall not be liable to the Contractor in any manner for any expenses, damages, loss of profits, anticipated or otherwise, or any other charge whatsoever arising out of an extension in the completion date of the work of either this Contract or any Contractor engaged on this Project.

39. STOPPAGE OF WORK BY ENGINEER

Should conditions arise which, in the opinion of the Engineer, warrant a stoppage of work, then the engineer may so direct. If the work is stopped and the Engineer subsequently directs its resumption, the Contractor shall resume full operation within the period of ten (10) calendar days after date of written notice. The Owner shall not be liable to the Contractor in any manner for any expenses, damages, loss of profits, anticipated or otherwise, or any other charges whatsoever arising out of the stoppage of the work of either this Contract or any Contractor engaged on this project. Any work done by the Contractor during the period of suspension shall be at his sole risk and he shall receive no pay therefore, unless the construction is subsequently ordered to be and is resumed and the work during the intervals of the suspension can be utilized in the resumed work.

In the event the Owner determines that any or all of the work as outlined in the Contract shall be terminated, the Contractor shall request payment for the percentage of the work that he actually has completed under the Contract.

The Owner will then determine the percentage of such work that has been completed and the Contractor will accept as full payment the sum of money determined by applying that percentage to the sum that would have been paid under the terms of the Contract, had all of the work been completed.

40. MONTHLY ESTIMATES AND PAYMENTS

Immediately following the receipt of executed copy of Contract, the Contractor shall submit, on forms approved by the Engineer, a detailed breakdown of all items of work entering into the Contract. This detailed breakdown will show quantities of the respective items and the allowances for labor, materials and other costs entering into each item. The detailed breakdown when approved by the Engineer shall be used as a basis by the Contractor in preparing monthly estimates for payment and shall, as accurately as possible, reflect the true division of cost of the respective items entering into the Contract.

As long as the work herein contracted for its prosecuted in accordance with the provisions of this Contract and with such progress as may insure completion by the date set forth in the Contract and to the satisfaction of the Engineer and owner, then

the Owner will make payment to the Contractor for the value of the work completed at monthly intervals.

Monthly estimates shall be prepared by the Contractor on forms approved by the Engineer and will indicate the quantity and value of the work done and materials incorporated by the Contractor to the end of the monthly estimate period. The monthly estimate will be forwarded by the Contractor, for approval to the Engineer, and he shall, in turn, forward it to the Owner. Materials in reasonable quantities that are delivered and accepted for incorporation in the work but not yet so used may be included on monthly estimates for payment.

The Contractor shall submit with the monthly estimate, reflecting the unincorporated material, original and two (2) copies of itemized receipt invoices showing payment for such material by the Contractor and delivery slips certifying to the delivery of the quantities set forth on the estimate to the site of this work, upon the property of the Owner.

The Contractor shall mark or identify such material and shall be solely responsible for its safekeeping and usability of the time it is to be incorporated in the structure or project, and shall, at his own expense, care for and protect the same and take out insurance against theft, loss from any other cause, damage, destruction and/or such other risks as may be involved, which would render the aforesaid materials unfit or unavailable for incorporation in the project.

Payment for materials stored at the site shall be based on 50% of actual cost for same as shown by the receipted invoices and shall not exceed the cost of materials as indicated on the approved "Breakdown Sheet" for the particular items involved. Monthly payments to the Contractor will be made on the basis of submission prepared by the Contractor as above explained. The form will require breakdown of total work completed to date of submission. From this total will be deducted ten percent (10%). From the resultant amount will be deducted all previous payments. The remainder, as approved, will constitute current amount due. The retained ten percent (10%) will be paid when the project has been finally accepted by the Owner. No estimates given or payment made shall be conclusive of the performance of the Contract either wholly or in part and no estimates or certificates of final payment shall be construed to be an acceptance of inferior or defective work or materials.

In Contracts exceeding \$50,000.00 for the construction, reconstruction, alteration or repair of any public building or other public work or public improvement, including heating or plumbing contracts, under the terms of which the Contractor is required to give a performance bond and labor and material payment bond, the Owner, in order to insure the proper performance of the Contract, shall withhold from the Contractor sums not to exceed 10% of the amount due the Contractor until 50% of the Contract

is completed. The sum or sums withheld by the Owner from the Contractor after the Contract is 50% completed shall not exceed 5% of the amount due the Contractor.

41. ACCEPTANCE AND FINAL PAYMENT

Whenever, in the opinion of the Engineer, the Contractor shall have completed his Contract in accordance with terms thereof, the Owner and the Engineer shall make a final observation of the entire work and, if satisfied that the Contractor has completely performed the Contract, the Contractor shall be instructed to submit a final estimate showing the entire amount of each class of work performed and the value thereof with such deductions as may be due the Owner under the Contracts or of such additions as may be due the Contractors. The total payments due to the Contractor cannot, however, exceed the sum authorized by the Owner under the terms of the Contract. The Engineer shall certify to the Owner the aggregate amount of said final estimates due to the Contractor and that all work in the Contract has been fully completed.

The final payment shall not become due and payable until the Contractor shall have furnished the Owner with satisfactory evidence that all labor and materials, outstanding claims and indebtedness of whatsoever nature arising out of the performance of the Contract have been paid, and until the Contractor shall have furnished a written General Release statement to such effect executed by Contractor and Sureties, which will further provide that payment to the Contractor of the final estimate shall not relieve any Surety of its obligation to the Owner as set forth in the Surety Bonds.

Where one or more claims against the Contractor, which are in controversy, appear unsatisfied, the Owner shall have the discretion to direct final payment to be withheld or a partial payment to be made from the retained percentage, should it be determined that the withholding of the entire final payment would work a hardship on the Contractor or delay the final payments to other Contractors on the project. If only partial payment is permitted under the paragraph from the retained percentage, final payment shall not be made until the Contractor shall have furnished satisfactory evidence and a statement from the Surety that all claims against the Contractor have been paid; that payment to the Contractor of the Contract balance shall not relieve any Surety of any of its obligations to the Owner as provided in the Surety Bond. The acceptance by the Contractor of the final payment made as aforesaid, shall operate as and be a release to the Owner and every member and agent thereof from all claims and liabilities to the Contractor for (1) anything done or furnished for, or relating to the work or (2) any act or neglect of the Owner, or of any person relating to or affecting the work, but his final payment shall not relieve the Contractor from his indemnity obligations under the terms of the Contract.

42. ESTOPPEL AND WAIVER OF LEGAL RIGHTS

Neither the Owner nor the Engineer shall be precluded or estopped by the measurements, estimate, or certificate, made or given by any of them or by any of their agents or employees, under any provision of the Contract, at any time, either before or after the completion and acceptance of the work and payment thereof, pursuant to any measurements, estimates, or certificate, from showing the true and correct amount or character of the work performed and materials furnished by the Contractor, nor from showing, at any time, that any such measurements, estimate or certificate is untrue or incorrectly made in any particular, or that the work or materials or any parts thereof do not conform in fact to Specifications and Contract. The Owner shall have the right to reject the whole or any part of the aforesaid work or materials should the said measurements, estimate, certificate or payments be found or be known to be inconsistent with terms of the Contract, or otherwise improperly given, and the Owner shall not be precluded or estopped notwithstanding any such measurements, estimate, or certificate or payment in accordance therewith from demands and recovering from the Contractor and/or his surety such damages as may sustain by reason of his failure to comply with the terms of the Specification and Contract, or on account of any over payments made on any estimate or certificate. Neither the acceptance by the Owner or Engineer or any of their agents or employees, nor any certificate approved for payment of money; nor any payments for, nor acceptance of, the whole or any part of the work by the Owner, nor any extension of time nor any possession taken by the Owner or its employees shall operate as a waiver of any portion of the Contract or any power therein reserved by the Owner, or any right to damages herein provided, nor shall any waiver of any breach of the Contract be held to be a waiver of any other or subsequent breach.

43. CHASES, THIMBLES, SLEEVES

The General Contractor shall construct, or have built into the building walls, floors, ceilings and partitions all chases, thimbles, sleeves, inserts, bolts, hangers and fastening devices that are necessary. All other prime or separate Contractors shall furnish to the General Contractor, for installation, all material in required locations.

If the foregoing has not been complied with within such time as may be necessary so that the work can progress along with the structure, then the Sub-contractor or separate Prime Contractor whose work is affected shall make and bear expenses for such changes incidental to the construction as may be required so that his work can be properly installed. All such work shall be undertaken only after securing the Engineer's approval.

44. HIRING, ETC.

That, in the hiring of employees for the performance of work under this Contract or any Sub-Contract hereunder, no Contractor, shall by reason of race, creed, or color or sex discriminate against any citizen of the Commonwealth of Pennsylvania who is qualified and available to perform the work to which employment relates.

45. SHOP DRAWINGS AND SAMPLES

Shop Drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor or Sub-contractor, manufacturer, supplier or distributor and which illustrate some portion of the work; samples are physical examples furnished by the Contractor to illustrate materials, equipment or workmanship and to establish standards by which the work will be judged.

The Contractor shall review, stamp with his approval and submit, with reasonable promptness and in orderly sequence so as to cause no delay in the work or in the work of any other Contractor, all shop drawings required by the Contract Documents or subsequently by the Engineer as covered by Modifications. Shop drawings and samples shall be properly identified as specified, or as the Engineer may require, Contractor shall notify the Engineer in writing of any deviation in the shop drawings from the requirements of the Contract Documents at the time of submission.

The Contractor shall make any corrections required by the Engineer and shall resubmit the required number of corrected copies of shop drawings or new samples until approved. The Contractor shall direct specific attention in writing or on resubmitted shop drawings to revisions other than the corrections requested by the Engineer on previous submissions.

The Engineer's approval of Shop Drawings or Samples shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has informed the Engineer in writing of such deviation at the time of submission and the Engineer has given written approval to the specific deviation, nor shall the Engineer's approval relieve the Contractor from responsibility for errors or omissions in the Shop Drawings or Samples.

For each Shop Drawing required, the Contractor shall submit one copy of an acceptable, legible, reproducible (sepia) print of the original tracing, along with two (2) prints. The Engineer will mark as previously specified and return corrected sepia print to Contractor. This process shall be repeated until approved shop drawings are received. Five (5) prints of approval sepia, along with the sepia print, will be finally submitted. All sepia prints will become the property of the Owner.

46. AS-BUILT DRAWINGS

At termination of work and before final payment, submit As-built drawings of the work completed.

After approval, submit one (1) corrected bound copy and two (2) electronic CD's in PDF Format.

47. REQUIRED BREAKDOWN OF PROJECT COSTS AND FORM FOR MONTHLY BILLINGS

American Institute of Architects Document G702, "Application and Certificate for Payment", and Document G702A, "Continuation Sheet", will be used for all monthly billings on this project.

48. PREVAILING WAGE RATES

If Prevailing Wage Rates apply, the Contractor shall conform to and be bound by the laws of the Commonwealth of Pennsylvania, relating to conditions of employment with respect to Act. No. 442. Prevailing Wage Rates apply to any project over \$25,000.00

49. CONTRACTOR'S SECURITY

Upon notice to the Contractor that he is the low bidder, and before award of the Contract, the Contractor shall furnish two (2) Bonds with Surety acceptable to the County, as follows:

One in the full amount of the Contract conditioned for the faithful performance of said Contract, including the indemnification of the Owner, in all respects set forth in these General Conditions and Specifications.

And the other for the full amount of the Contract conditioned to pay for all labor and materials which may be furnished to the Contract or which may enter into the Contract with right in all persons, firms or Corporation furnishing such labor or materials to sue on said Bond in the name of the Owner, for his, their, or its use.

The Delaware County Council will also require a Maintenance Bond in the amount of ten percent (10%) of the Contract price conditioned that the Principal shall remedy, without cost to the Owner, any defects which may develop during the period of one (1) year from date of completion and acceptance of the work performed under the Contract.

To each Bond shall be attached a recent financial statement of the Surety, along with a Power of Attorney showing that the person signing the Bonds on behalf of the Surety has power to do so.

The surety Bonds are subject to the approval of County Council. No Surety Bond will be approved unless the bonding Company shall have a rating of at least "B+" in Best's Key Rating Guide and shall be approved by the United States Department of the Treasury as a surety Company acceptable on Federal Bonds. In addition, the bonding Company shall have been registered with the Office of judicial support and the Office for Recording of Deeds of the **County of Delaware**.

The bonds shall be duly executed by the successful bidder as principal and by the signers of the Agreement of Prepared Surety, or Sureties. If the Owner determines that the Sureties are not acceptable, the bidder shall replace the bond with bonds offered by Sureties, which are acceptable to the Council within ten (10) calendar days of notification by the Council.

50. STEEL PRODUCTS

In accordance with the Pennsylvania Steel Products Procurement Act #1978-3, it is required that if any steel products are to be used or supplied in the performance of the Contract only steel products as defined in said act shall be used or supplied in the performance of the Contract or any sub-contracts thereunder.

Steel products as defined in said act are products made from steel made in the United States by the open hearth, basic oxygen, electric furnace, Bessemer or other steel making process. These steel products include products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two or more of such operations.

51. MATERIAL SAFETY DATA SHEETS (MSDS)

Material Safety Data Sheets (MSDS) must be submitted for respective products with the Bid proposal, in compliance with the Federal Hazard Communication Standard Act (29 CFR 1910, 1200) and various State Right-to-Know laws.

52. GENERAL NOTES

Contracts shall be awarded to the lowest responsible bidder. In determining "lowest responsible bidder", in addition to price, the Central Purchasing Department in its pre-award evaluation shall, in consultation with the affected department head, ascertain and consider:

- a. The expertise of the bidder to perform the Contract or provide the service required;

- b. Whether the bidder can perform the Contract or provide the service promptly, or within the time specified and with adequate supervisory personnel;
- c. The character, integrity, reputation and judgment of the bidder;
- d. The quality of performance on previous contracts and services;
- e. The previous and existing compliance by the bidder with laws and ordinances relating to the Contract or service;
- f. The sufficiency of the financial resources of the bidder to perform the Contract or provide the service;
- g. The ready availability of supplies necessary to discharge performance in a prompt and workmanlike manner;
- h. The ability of the bidder to provide future maintenance and services for the use of the subject Contract;
- i. The number and scope of conditions attached to the bid.

(The acceptance of all bids for contracts is made expressly conditional upon a satisfactory rating from a pre-award investigation conducted by the Central Purchasing Department).

The following will automatically disqualify a low bidder:

- a. Default on the payment of taxes, licenses, or other monies due the County.
- b. Default, breach or repudiation on past contracts which reflect a course of performance deemed deleterious to the County's best interest.

When the award is not given to the lowest bidder, a full and complete statement of the reasons for placing the order elsewhere shall be prepared by the Central Purchasing Department and filed with the other papers relating to the transaction.

No verbal instructions or information will be binding. These specifications will be considered clear and complete unless attention is directed in writing to the Director of Public Works, County of Delaware, Delaware County Government Center, Media, Pennsylvania, to any apparent discrepancies or omissions thereof, before the opening of the Bids. Bidders should act promptly and allow sufficient time for replay to reach them before the submission of their Bids. Should any change in Specifications be required, an Addendum will be issued to all Bidders and receipt by the Bidders of the Form of Addendum must be acknowledged in space provided on Proposal Page.

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Forms of Proposal are provided in these Specifications. This form must be used in submitting Proposal and must be signed by the Bidder.

DELAWARE COUNTY SPECIAL CONDITIONS

These General Conditions shall apply to the Contract as a whole, and to each and all branches or sub-divisions and contractors for same, should the work be divided. Sub-contractors shall have access to read a copy of these Special Conditions and no Contract or arrangements with them shall be such as to conflict herewith. Any requirements contained in the General Conditions which differ from any requirements contained in these "Special Conditions" shall be superseded by the requirements of these "Special Conditions".

1. ARRANGEMENT OF THE SPECIFICATIONS

- A. The Contractor is advised that the arrangement of the technical sections of the Specifications is furnished for his convenience only. The allocation of items of work between his Sub-contractors is entirely the responsibility of the Contractor.
- B. The Prime Contractors shall have a project foreman on-site whenever a Sub-contractor of the Prime Contractor is on-site to perform work. Sub-contractors shall submit all Owner related items to project foreman including operational and facility inquiries, building / room access. Scheduling conflicts and site coordination requests. It is the sole responsibility of the Prime Contractors to engage with Owner and Engineer, or their designated representatives to satisfy the Sub-contractors request.
- C. Materials and installation shall comply with the appropriate technical section of this specification unless otherwise indicated.

2. SAFETY DURING CONSTRUCTION

- A. The Contractor shall enforce suitable rules and provide the required guards and protective devices for the safe prosecution of the work and for the safety and health of the men employed in it and the public in general, both inside and outside the limit of Contract. The contractors are responsible for compliance with the Federal Occupational Safety and Health Act of 1970.
- B. The Prime Contractor and all Sub-contractors shall immediately report all accidents, injuries, or health hazards to the Owner and Engineer, or their designated representatives, in writing.
- C. It shall be the single and sole responsibility of the Contractor to ensure

that his activities comply with all applicable safety requirements, including, but not limited to local, state and federal regulations. Neither the Engineer nor the Owner shall owe any duty under this Contract or otherwise to the Contractor or its agents, employees or guests to inspect the work or otherwise ensure compliance by the Contractor with applicable safety requirements. No increases in the Contract price or extensions in the Contract time of completion shall be given by the Owner as the consequence of the Contractor's failure to so comply.

3. STANDARD OF QUALITY

See General Condition, Paragraph 17.

4. SUBSTITUTIONS OF MATERIAL

Bidders wishing to obtain acceptance on items other than those specified by name shall submit their request to the Engineer not less than ten (10) days before the bid opening, provided that such request is in accordance with the terms of conditions of the Contract Documents.

Acceptance by the Engineer will be in the form of an addendum to the Specifications issued to all prospective bidders indicating that the additional brand or brands are approved as equal to those specified so far as the requirements of the project are concerned. If the bidders do not elect to obtain prior approval during the time so specified, they have thereby evidenced their intention and are bound to provide all those articles and brand names stated in the Specifications.

5. CASH ALLOWANCES

In accordance with the Commonwealth of Pennsylvania Laws and Regulations, no cash allowances are included in the Project Manual and Contracts.

The Drawings and / or Specifications indicate the standard of quality and the finite quantity of materials and work, specialties, and items of work required, where such quantities can be determined prior to commencement of the work.

In those instances where it is known that quantities required may exceed those specified, as the result of conditions impossible to anticipate, the Contractor shall state in his Proposal the unit price for such additional work, but no cash allowance for such additional quantity will be permitted.

6. DAMAGE TO PROPERTY

See General Conditions, Paragraph 31.

7. CLEAN-UP

The Contractor shall be responsible for periodic cleaning up of the building and premises. He shall remove all refuse of any kind regardless as to who may have left it. No rubbish shall be burned at the site. The Contractor shall also be responsible for keeping all property outside of the immediate work areas and material storage areas clean and free from all equipment, materials, and debris. If any condition in violation of this requirement persists more than twenty-four (24) hours after notification by the Owner or Engineer, the Owner shall have the right to abate the condition (without notice to the Contractor responsible) and charge the cost of abatement to the responsible Contractor.

8. DRAWINGS AND SPECIFICATIONS FURNISHED TO CONTRACTORS

Following the execution of their respective Contracts, Contractors shall be entitled to receive from the Engineer, without charge, sets of Contract Drawings and Specifications as follows:

A. Prime Contractors – 3 sets

Should a Contractor require a greater number of copies of Drawings and Specifications than above provided, he shall arrange to obtain them from the Engineer and pay the cost involved.

9. WARRANTY

Supplementing any specific guarantee or warranties provided for in any other provision of this Contract for the work to be performed hereunder; each Contractor covenants and agrees to remedy without cost to the Owner, any defect which may develop one (1) year from the date of completion and acceptance of the work performed under this Contract, or damage which may be caused by such defects, provided such defects, in the judgment of the Owner, are caused by inferior materials and workmanship.

10. OPERATIONS AND STORAGE AREAS

All operations of the Contractor (including storage of materials) shall be confined to areas authorized or approved by the Owner. No unauthorized or unwarranted entry upon, passage through, or storage or disposal of material

shall be made upon area not so authorized or approved. The Contractor responsible shall be liable for any and all damage caused by him to such area.

11. SCAFFOLDS, LADDERS, RUNS, AND HOISTS

The Contractor shall construct and maintain such temporary scaffolds, ladders, runs, hoists, centering, shoring, and other facilities as required to construct the work under his contract.

12. TIME FOR COMMENCEMENT AND COMPLETION

See General Conditions, Paragraph 34.

13. CODES AND PERMITS

See General Conditions, Paragraphs 26 and 27.

14. GENERAL SCOPE OF WORK

See General Conditions, Paragraph 4.

15. INDEMNIFICATION AGAINST SUITS

The Contractor shall indemnify and save harmless the Owner, the Board, its members and officers, the Engineer, his assistants, and all others who may act for the Board or the Owner from all suits and actions of every kind, nature, and description brought by anyone whatsoever against them or any of them in any manner connected with the contract here proposed or the work thereunder; provided that nothing herein stated shall be construed to preclude the Contractor from maintaining an action at law for money which may be due to him under the Contract.

16. COMPETENT WORKMEN – RATES OF WAGES

No person shall be employed to do work under such Contract except competent and first-class workmen and mechanics. No workmen shall be regarded as competent and first-class, within the meaning of this clause, except those who are fully skilled in their respective branches of labor, and who shall be paid not less than such rates of wages and for such hours' work as shall be the established and current rate of wages paid for such hours by employers or organized labor in doing of similar work in the general geographical location of the project.

17. LINES, LEVELS, ETC.

The Contractor shall, at his own expense, procure datum information, grades, elevations, verify existing construction, etc., at the site, before starting work, otherwise any cost of correction shall be entirely at the contractor's expense.

18. REGULATIONS FOR PENNSYLVANIA PREVAILING WAGE ACT

- A. The general prevailing minimum wage rates including contributions for employee benefits as shall have been determined by the Secretary which must be paid to the workmen employed in the performance of the contracts.

The Contractor shall pay no less than the wage rates as determined in the decision of the Secretary of Labor and Industry and shall comply with the conditions of the Pennsylvania Prevailing Wage Act approved August 15, 1961 (No. 442), as amended August 9, 1963 (No. 342), and the Regulations issued pursuant thereto, to assure the full and proper payment of said wages.

- B. The contract provisions shall apply to all work performed on the Contract by the Contractor and to all work performed on the Contract by the Sub-contractors.
- C. The Contractor shall insert in each of the Sub-contracts all of the stipulations contained in these required provisions and such other stipulations as may be required.
- D. The Contract shall provide that no workmen may be employed on the public 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 procedures set forth in Section 7 of these Regulations shall be followed.
- E. The Contract shall provide that all workmen employed or working on the public work shall be paid unconditionally, regardless of whether any contractual relationship exists or the nature of any contractual relationship which may be alleged to exist between any contractor, sub-contractor and workmen, not less than once a week without deduction or rebate, on any account, either directly or indirectly, except authorized deductions, the full amounts due at the time of payment, computed at the rates applicable to the time worked in the appropriate classification. Nothing in the contract,

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the Act or these Regulations shall prohibit the payment of more than the general prevailing minimum wage rates as determined by the Secretary to any workmen on public work.

- F. The Contract shall provide that the Contractor and each Sub-contractor 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 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 for which it is being 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 determination 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 Sub-contractor are not complying with the Act or these Regulations in any manner whatsoever they may file a protest in writing with the Secretary of Labor and Industry within three months of the date of the occurrence, objecting to the payment by any contractor to the extent of the amount or amounts due or to become due to them as wages for work performed on the public work project.

Any workman paid less than the rate specified in the Contract shall have a civil right of action for the difference between the wage paid and the wages stipulated in the contract, which right of action must be exercised within six months from the occurrence of the event creating such right.

- G. The Contract shall provide that the Contractor and all Sub-contractors 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 public work and such record must include any deductions from each workman. The record shall be preserved for two

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- years from the date of payment and shall be open at all reasonable hours to the inspection of the public body awarding the contract and to the Secretary of his duly authorized representatives.
- H. The Contract shall provide that 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 (No. 304) and the Rules and Regulations issued pursuant thereto shall be employed on the public work project. Any workman using the tools of a craft who does not qualify as an apprentice within the provisions of this subsection shall be paid the rate predetermined for journeyman in that particular craft and / or classification.
- I. Wages shall be paid without any deductions except authorized deductions. Employers not parties 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 workmen.
- J. Payment of compensation to workmen for work performed on public work on a lump sum basis, or a piece 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 these Regulations, regardless of the average hourly earnings resulting therefrom.
- K. The Contract shall also provide that each contractor and each sub-contractor shall file a statement each week and a final statement at the conclusion of the work on the Contract with the contracting agency, 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 this Section 3 of these Regulations, or if any wages remain unpaid to set forth the amount of wages due and owing to each workman respectively.
- L. The provisions of the Act and the Regulations are hereby incorporated by reference in the Contract.

19. LIQUIDATED DAMAGES

- A. The Owner will suffer damages if the construction contract(s) is not complete as set forth in the Proposal Form(s).
- B. The Contractor and Contractor's surety company shall be liable for and shall pay to the Owner the sum of \$500.00 per day as Liquidated Damages for each calendar day of delay until the construction contract is complete.

20. PROJECT SCHEDULE

- A. Provide Project Schedule in accordance with other Sections of these Specifications.
- B. Include within the Project Schedule the related work activities of all trades by task / event with completion time frame, allowable slippage and critical start and finish dates. Incorporate milestones for Owner responsibilities.
- C. Acceptable formats for presentation of Project Schedule include:
 - 1. Simplified overlapping and coordinated bar charts with a timeline and activity dates and duration.
 - 2. A network schedule using the critical path method (cpm) of plotting nodes (events) and connecting arrows (activities).
- D. Update the Project Schedule as required to accommodate field and project conditions. Issue an updated Project Schedule to the Owner for review and approval every Three (3) weeks or as required to inform the Owner of deviations and revisions.
- E. The project shall be complete and operational in the time frame specified in Section B, Instructions to Bidders, Time for Completing Work. The time for completing work stated in Instructions to Bidders, Time for Completing Work shall be considered the contract limit as defined in the Proposal Form in section C. It is understood that the County may, on its own decision or initiate, extend the completion date by giving notice to all parties to this contract of its intention to extend. The County shall not be liable for any expenses, damages, loss of profits, anticipated or otherwise for extending this contract.

21. APPRENTICESHIP TRAINING

- A. A bidder and all sub-contractors they may eventually employ on this Project shall each be a participant in a state or federally approved Apprenticeship Training Program. Each bidder shall submit with his / her proposal a complete description of the Apprenticeship Training Program in which the bidder participates. The bidder shall also provide with his / her bid a written statement that if awarded a contract, the bidder will employ apprentices enrolled in a state or federally approved Apprenticeships Training Program under the direction of experienced supervisors.
- B. If requested by the Owner, the bidder shall submit within three (3) days of the date of the request, the name, address, and telephone number of the state and federal agency which certifies the bidder's Apprentice / Training Program and the bidders identification number (if any) that would enable the Owner's representative to verify the information provided by the bidder.
- C. Failure of a bidder to provide information as required under this paragraph shall be cause for disqualification of the bidder's proposal.

22. AFFIRMATIVE ACTION PROGRAM

- A. Each bidder shall have a formal documented Affirmative Action Program and must provide with his / her proposal a written statement describing the exact nature, scope and history of their Affirmative Action Program in the interest of extending work opportunities to qualified minority workers.
- B. Failure of a bidder to provide information as required under this paragraph shall be cause for disqualification of the bidder's proposal.

23. SUB-CONTRACTOR ON SITE

Prime Contractors shall have a project foreman on-site whenever a Sub-contractor of such Prime Contractor is on-site to perform work. Sub-contractors shall submit all Owner related items to project foreman including operational and facility inquiries, building / room access, scheduling conflicts and site coordination requests. It is the sole responsibility of the Prime Contractors to engage with Owner and Engineer, or their designated representatives to satisfy the Sub-contractor's request.

24. CRIMINAL BACKGROUND CHECK POLICY

The County will require all construction workmen working at the Facility to undergo a criminal background check. See Employee Background Requirements listed in Appendix B.

Contractor Responsibility Requirements for Construction of \$500,000.00 or more:

Chapter 29 of the Delaware County Code requires that as a condition of performing work on certain public works contracts, a firm seeking award of a contract shall submit a Contractor Responsibility Certification. Delaware County has determined that the contract subject to this Invitation to Bid is covered by Chapter 29, and that firms responding to this Invitation to Bid must submit this form and otherwise comply with the provisions of Chapter 29 as well as Delaware County Resolution Number 2022-3 (Regarding Goals for Diversity in Public Works Contracting).

The Contractors Responsibility Certification must be completed/submitted on the form contained within this Invitation to Bid package.

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

A bidder shall submit with their bid documents a subcontractor list containing the names of subcontractors that will be used for the referenced project, their addresses and a description of the work each listed subcontractor will perform on the project.

If the firm receives a Notice of Intent to Award Contract, it agrees to provide Subcontractor Responsibility Forms and any required subcontractor information within fourteen days (Director of Public Works may extend such deadline upon good justification by firm). All provisions of this section shall be applicable to all subcontractors of subcontractors.

The Department of Public Works shall ensure that the contractor responsibility certification, the subcontractor list and subcontractor responsibility certifications, as required, have been submitted and properly executed.

The Department of Public Works may conduct any additional inquiries to verify a bidder or proposer (hereinafter collectively referred to as “bidder”) and its subcontractors have the technical qualifications and performance capabilities necessary to successfully perform the contract and that the firms have a sufficient record of law compliance and business integrity to justify the award of a public contract. In conducting such inquiries, the Department of Public Works may seek relevant information from the firm, its prior clients or customers, its subcontractors or any other relevant source.

Subcontractor responsibility review requirements

A construction manager, general contractor or other lead or prime contractor shall not be permitted to use a subcontractor on any work performed for the County of Delaware unless it has identified the subcontractor on its subcontractor list and provided a subcontractor responsibility certification.

A subcontractor listed on a firm's subcontractor list shall not be substituted unless written authorization is obtained from the Department of Public Works and a subcontractor

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responsibility certification is provided for the substitute subcontractor.

In the event that the Department of Public Works determines that a prospective subcontractor listed by a bidder does not meet the responsibility standards of this resolution, it may, after informing the bidder, exercise one of the following options:

1. Permit the bidder to substitute a qualified, responsible subcontractor in accordance with the requirements of this resolution;
2. Require the bidder to self-perform the work in question if the firm has the required experience, licenses and other qualifications to perform the work in question; or
3. Disqualify the bidder.

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

NONDISCRIMINATION/SEXUAL HARASSMENT CLAUSE

The Contactor agrees:

1. In the hiring of any employee(s) for the manufacture of supplies, performance of work, or any other activity required under the contract or any sub-contract, the Contractor, each sub-contractor, or any person acting on behalf of the Contractor or sub-contractor, shall not, discriminate in violation of the *Pennsylvania Human Relations Act* (PHRA) and applicable federal laws against any citizen, who is qualified and available to perform the work to which the employment relates.
2. Neither the Contractor nor any sub-contractor nor any person on their behalf shall in any manner discriminate in violation of the PHRA and applicable federal laws against or intimidate any employee involved in the manufacture of supplies, the performance or work, or any other activity required under the contract.
3. The Contractor and each sub-contractor shall establish and maintain a written nondiscrimination and sexual harassment policy and shall inform their employees of the policy. The policy must contain a provision 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 employees at or near where the contract services are performed shall satisfy this requirement.
4. The Contractor and each sub-contractor shall not discriminate in violation of PHRA and applicable federal laws against any sub-contractor or supplier who is qualified to perform the work to which the contract relates.
5. The Contractor and each sub-contractor 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 sub-contractor 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 sub-contracts and have 50 or more employees. The Contractor and each sub-contractor shall, upon request and within the time periods requested by the County, furnish all necessary employment documents and records, including EEO-1 reports and permit access to their books, records and accounts by the contracting agency and the Bureau of Small Business

Section T
Nondiscrimination/Sexual Harassment Clause

Opportunities (BSBO), for purpose of ascertaining compliance with provisions of the Nondiscrimination/Sexual Harassment Clause.

6. The Contractor shall include the provisions of this Nondiscrimination/Sexual Harassment Clause in every sub-contract so those provisions applicable to sub-contractors will be binding upon each sub-contractor.
7. The Contractor's and each sub-contractor's obligation pursuant to these provisions are ongoing from and after the effective date of the contract through termination date thereof. Accordingly, the Contractor and each sub-contractor shall have an obligation to inform the County if, at any time during the term of the Contract, it becomes aware of any actions or occurrences that would result in violation of these provisions.
8. The County may cancel or terminate the Contract and all money due or to become due under the Contract may be forfeited for a violation of the terms and conditions of the Nondiscrimination/Sexual Harassment Clause.

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project Name:	Government Center Garage Sprinkler Piping & Fire Pump Modifications
Awarding Agency:	County of Delaware
Contract Award Date:	1/6/2023
Serial Number:	22-08288
Project Classification:	Building
Determination Date:	10/27/2022
Assigned Field Office:	Philadelphia
Field Office Phone Number:	(215)560-1858
Toll Free Phone Number:	
Project County:	Delaware County

BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 22-08288 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Asbestos & Insulation Workers	5/1/2021		\$54.35	\$39.95	\$94.30
Boilermaker (Commercial, Institutional, and Minor Repair Work)	1/1/2019		\$29.26	\$18.48	\$47.74
Boilermakers	1/1/2021		\$49.32	\$34.90	\$84.22
Boilermakers	1/1/2022		\$50.17	\$35.30	\$85.47
Bricklayer	5/1/2021		\$45.45	\$30.61	\$76.06
Bricklayer	5/1/2022		\$46.45	\$31.06	\$77.51
Carpenter - Chief of Party (Surveying & Layout)	5/1/2021		\$47.47	\$28.71	\$76.18
Carpenter - Instrument Person (Surveying & Layout)	5/1/2021		\$41.28	\$28.71	\$69.99
Carpenter - Rodman (Surveying & Layout)	5/1/2021		\$20.64	\$20.31	\$40.95
Carpenters	5/1/2021		\$41.28	\$28.71	\$69.99
Carpenters	5/1/2022		\$42.53	\$28.71	\$71.24
Cement Finishers & Plasterers	5/1/2022		\$38.57	\$32.39	\$70.96
Cement Masons	5/1/2021		\$40.70	\$33.46	\$74.16
Cement Masons	5/1/2022		\$42.05	\$33.46	\$75.51
Dockbuilder, Pile Drivers	5/1/2022		\$45.73	\$37.99	\$83.72
Dockbuilder, Pile Drivers	10/31/2022		\$47.23	\$37.99	\$85.22
Dockbuilder, Pile Drivers	5/1/2023		\$50.48	\$37.99	\$88.47
Dockbuilder, Pile Drivers	5/1/2024		\$52.98	\$37.99	\$90.97
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	5/1/2022		\$57.16	\$37.99	\$95.15
Dockbuilder/ Pile driver diver	10/31/2022		\$58.66	\$37.99	\$96.65
Dockbuilder/ Pile driver diver	5/1/2023		\$63.10	\$37.99	\$101.09
Dockbuilder/ Pile driver diver	5/1/2024		\$66.25	\$37.99	\$104.24
Dockbuilder/ Pile driver diver	5/1/2025		\$69.04	\$37.99	\$107.03
Dockbuilder/ Pile driver diver	5/1/2026		\$71.23	\$37.99	\$109.22
Dockbuilder/pile driver tender	5/1/2022		\$45.73	\$37.99	\$83.72
Dockbuilder/pile driver tender	10/31/2022		\$47.23	\$37.99	\$85.22
Dockbuilder/pile driver tender	5/1/2023		\$50.48	\$37.99	\$88.47
Dockbuilder/pile driver tender	5/1/2024		\$52.98	\$37.99	\$90.97
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
Drywall Finisher	5/1/2022		\$38.93	\$29.96	\$68.89
Electricians	5/29/2017		\$43.16	\$28.46	\$71.62
Electricians	6/4/2018		\$42.87	\$30.41	\$73.28
Electricians	6/3/2019		\$42.87	\$32.41	\$75.28
Electricians	6/1/2020		\$44.47	\$33.31	\$77.78
Electricians	5/31/2021		\$46.06	\$34.22	\$80.28
Electricians	5/30/2022		\$47.64	\$35.14	\$82.78
Electricians	5/29/2023		\$49.24	\$36.04	\$85.28
Elevator Constructor	1/1/2021		\$61.43	\$36.36	\$97.79
Floor Coverer	5/1/2021		\$45.74	\$29.21	\$74.95
Floor Coverer	5/1/2022		\$48.00	\$29.21	\$77.21
Floor Coverer	5/1/2023		\$50.12	\$29.21	\$79.33

BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 22-08288 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Floor Coverer	5/1/2024		\$52.19	\$29.21	\$81.40
Floor Layer	5/1/2018		\$43.11	\$28.09	\$71.20
Glazier	5/1/2021		\$45.67	\$34.38	\$80.05
Glazier	5/1/2022		\$46.09	\$35.61	\$81.70
Interior Finish	5/1/2019		\$30.20	\$25.80	\$56.00
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2021		\$47.70	\$39.51	\$87.21
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2022		\$49.70	\$39.51	\$89.21
Iron Workers (Riggers)	7/1/2017		\$39.83	\$27.92	\$67.75
Ironworker (Rodman)	7/1/2020		\$44.82	\$31.60	\$76.42
Laborers (Class 01 - See notes)	5/1/2020		\$32.05	\$25.25	\$57.30
Laborers (Class 01 - See notes)	5/1/2022		\$33.35	\$25.65	\$59.00
Laborers (Class 02 - see notes)	5/1/2020		\$35.15	\$26.15	\$61.30
Laborers (Class 02 - see notes)	5/1/2022		\$36.70	\$27.00	\$63.70
Laborers (Class 03 - See notes)	5/1/2020		\$32.47	\$25.43	\$57.90
Laborers (Class 03 - See notes)	5/1/2022		\$33.77	\$25.83	\$59.60
Laborers (Class 04 - See notes)	5/1/2020		\$32.47	\$25.43	\$57.90
Laborers (Class 04 - See notes)	5/1/2022		\$33.77	\$25.83	\$59.60
Laborers (Class 05 - See notes)	5/1/2020		\$32.05	\$25.25	\$57.30
Laborers (Class 05 - See notes)	5/1/2022		\$33.35	\$25.65	\$59.00
Landscape Laborer	5/1/2020		\$26.55	\$23.13	\$49.68
Marble Finisher	5/1/2022		\$38.27	\$29.15	\$67.42
Marble Mason	5/1/2022		\$45.90	\$31.20	\$77.10
Mason Tender, Cement	5/1/2019		\$30.52	\$25.98	\$56.50
Millwright	5/1/2021		\$48.60	\$33.19	\$81.79
Millwright	5/1/2022		\$49.83	\$34.53	\$84.36
Operators (Building, Class 01 - See Notes)	5/1/2021		\$49.50	\$31.51	\$81.01
Operators (Building, Class 01 - See Notes)	5/1/2022		\$51.04	\$31.97	\$83.01
Operators (Building, Class 01A - See Notes)	5/1/2021		\$52.51	\$32.39	\$84.90
Operators (Building, Class 01A - See Notes)	5/1/2022		\$54.05	\$32.85	\$86.90
Operators (Building, Class 02 - See Notes)	5/1/2021		\$49.25	\$31.44	\$80.69
Operators (Building, Class 02 - See Notes)	5/1/2022		\$50.79	\$31.90	\$82.69
Operators (Building, Class 02A - See Notes)	5/1/2021		\$52.26	\$32.32	\$84.58
Operators (Building, Class 02A - See Notes)	5/1/2022		\$53.81	\$32.77	\$86.58
Operators (Building, Class 03 - See Notes)	5/1/2021		\$45.16	\$30.24	\$75.40
Operators (Building, Class 03 - See Notes)	5/1/2022		\$46.71	\$30.69	\$77.40
Operators (Building, Class 04 - See Notes)	5/1/2021		\$44.87	\$30.14	\$75.01
Operators (Building, Class 04 - See Notes)	5/1/2022		\$46.41	\$30.60	\$77.01
Operators (Building, Class 05 - See Notes)	5/1/2021		\$43.14	\$29.64	\$72.78
Operators (Building, Class 05 - See Notes)	5/1/2022		\$44.69	\$30.09	\$74.78
Operators (Building, Class 06 - See Notes)	5/1/2021		\$42.16	\$29.34	\$71.50
Operators (Building, Class 06 - See Notes)	5/1/2022		\$43.70	\$29.80	\$73.50
Operators (Building, Class 07A- See Notes)	5/1/2021		\$60.00	\$36.21	\$96.21
Operators (Building, Class 07A- See Notes)	5/1/2022		\$61.86	\$36.75	\$98.61

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 22-08288 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators (Building, Class 07B- See Notes)	5/1/2021		\$59.72	\$36.11	\$95.83
Operators (Building, Class 07B- See Notes)	5/1/2022		\$61.57	\$36.66	\$98.23
Painters Class 1 (see notes)	5/1/2021		\$41.24	\$30.29	\$71.53
Painters Class 1 (see notes)	2/1/2022		\$41.77	\$31.61	\$73.38
Painters Class 4 (see notes)	5/1/2021		\$41.62	\$30.29	\$71.91
Painters Class 4 (see notes)	5/1/2022		\$41.77	\$31.61	\$73.38
Plasterers	5/1/2021		\$38.37	\$31.84	\$70.21
plumber	5/1/2021		\$59.83	\$36.16	\$95.99
plumber	5/1/2022		\$62.73	\$36.61	\$99.34
Pointers, Caulkers, Cleaners	5/1/2021		\$46.75	\$29.50	\$76.25
Pointers, Caulkers, Cleaners	5/1/2022		\$47.64	\$30.06	\$77.70
Roofers (Composition)	5/1/2021		\$40.33	\$33.12	\$73.45
Roofers (Composition)	5/1/2022		\$41.48	\$33.87	\$75.35
Roofers (Shingle)	5/1/2021		\$30.50	\$21.55	\$52.05
Roofers (Slate & Tile)	5/1/2021		\$33.50	\$21.55	\$55.05
Sheet Metal Workers	5/1/2021		\$53.84	\$45.94	\$99.78
Sheet Metal Workers	5/1/2022		\$55.75	\$47.28	\$103.03
Sign Makers and Hangars	7/17/2021		\$29.49	\$23.90	\$53.39
Sign Makers and Hangars	7/15/2022		\$30.54	\$24.35	\$54.89
Sprinklerfitters	5/1/2021		\$60.83	\$30.34	\$91.17
Sprinklerfitters	5/1/2022		\$62.79	\$31.43	\$94.22
Steamfitters	5/1/2021		\$60.47	\$40.89	\$101.36
Steamfitters	5/1/2022		\$64.57	\$40.59	\$105.16
Stone Masons	5/1/2021		\$44.90	\$30.75	\$75.65
Stone Masons	5/1/2022		\$45.90	\$31.20	\$77.10
Terrazzo Finisher	5/1/2022		\$42.44	\$27.71	\$70.15
Terrazzo Grinder	5/1/2022		\$42.71	\$27.71	\$70.42
Terrazzo Mechanics	5/1/2021		\$48.01	\$28.81	\$76.82
Terrazzo Mechanics	5/1/2022		\$48.81	\$29.46	\$78.27
Tile Finisher	5/1/2022		\$38.27	\$29.15	\$67.42
Tile Setter	5/1/2022		\$48.81	\$29.46	\$78.27
Truckdriver class 1(see notes)	5/1/2021		\$36.48	\$17.96	\$54.44
Truckdriver class 2 (see notes)	5/1/2021		\$36.58	\$17.96	\$54.54
Truckdriver class 3 (see notes)	5/1/2021		\$36.83	\$17.96	\$54.79
Window Film / Tint Installer	6/1/2019		\$24.52	\$12.08	\$36.60

BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 22-08288 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Carpenter - Chief of Party (Surveying & Layout)	5/1/2021		\$59.93	\$27.69	\$87.62
Carpenter - Chief of Party (Surveying & Layout)	5/1/2022		\$60.71	\$29.06	\$89.77
Carpenter - Chief of Party (Surveying & Layout)	5/1/2023		\$63.24	\$29.06	\$92.30
Carpenter - Chief of Party (Surveying & Layout)	5/1/2024		\$65.19	\$29.06	\$94.25
Carpenter - Chief of Party (Surveying & Layout)	5/1/2025		\$67.15	\$29.06	\$96.21
Carpenter - Chief of Party (Surveying & Layout)	5/1/2026		\$69.10	\$29.06	\$98.16
Carpenter - Instrument Person (Surveying & Layout)	5/1/2021		\$52.11	\$27.69	\$79.80
Carpenter - Instrument Person (Surveying & Layout)	5/1/2022		\$52.79	\$29.06	\$81.85
Carpenter - Instrument Person (Surveying & Layout)	5/1/2023		\$54.99	\$29.06	\$84.05
Carpenter - Instrument Person (Surveying & Layout)	5/1/2024		\$56.69	\$29.06	\$85.75
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)	5/1/2021		\$41.69	\$21.34	\$63.03
Carpenter - Rodman (Surveying & Layout)	5/1/2022		\$42.23	\$22.41	\$64.64
Carpenter - Rodman (Surveying & Layout)	5/1/2023		\$43.99	\$22.41	\$66.40
Carpenter - Rodman (Surveying & Layout)	5/1/2024		\$45.35	\$22.41	\$67.76
Carpenter - Rodman (Surveying & Layout)	5/1/2025		\$46.71	\$22.41	\$69.12
Carpenter - Rodman (Surveying & Layout)	5/1/2026		\$48.07	\$22.41	\$70.48
Carpenter	5/1/2021		\$51.76	\$28.04	\$79.80
Carpenter	5/1/2022		\$52.79	\$29.06	\$81.85
Carpenter	5/1/2023		\$54.99	\$29.06	\$84.05
Carpenter	5/1/2024		\$56.69	\$29.06	\$85.75
Carpenter	5/1/2025		\$58.49	\$29.06	\$87.55
Carpenter	5/1/2026		\$60.19	\$29.06	\$89.25
Cement Masons	5/1/2021		\$39.65	\$33.41	\$73.06
Dockbuilder, Pile Drivers	5/1/2022		\$45.73	\$37.99	\$83.72
Dockbuilder, Pile Drivers	11/1/2022		\$47.23	\$37.99	\$85.22
Dockbuilder, Pile Drivers	5/1/2023		\$50.48	\$37.99	\$88.47
Dockbuilder, Pile Drivers	5/1/2024		\$52.98	\$37.99	\$90.97
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/ Divers (Building Heavy & Highway)	5/1/2020		\$52.44	\$37.27	\$89.71
Dockbuilder/ Pile driver diver	5/1/2022		\$57.16	\$37.99	\$95.15
Dockbuilder/ Pile driver diver	11/1/2022		\$59.04	\$37.99	\$97.03
Dockbuilder/ Pile driver diver	5/1/2023		\$63.10	\$37.99	\$101.09
Dockbuilder/ Pile driver diver	5/1/2024		\$66.25	\$37.99	\$104.24
Dockbuilder/ Pile driver diver	5/1/2025		\$69.04	\$37.99	\$107.03
Dockbuilder/ Pile driver diver	5/1/2026		\$71.23	\$37.99	\$109.22
Dockbuilder/pile driver tender	5/1/2022		\$45.73	\$37.99	\$83.72
Dockbuilder/pile driver tender	11/1/2022		\$47.23	\$37.99	\$85.22
Dockbuilder/pile driver tender	5/1/2023		\$50.48	\$37.99	\$88.47
Dockbuilder/pile driver tender	5/1/2024		\$52.98	\$37.99	\$90.97
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

BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 22-08288 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
DockBuilder/Pile Drivers/ Diver Tender	5/1/2020		\$43.70	\$37.27	\$80.97
Electric Lineman	5/31/2021		\$57.93	\$30.22	\$88.15
Electric Lineman	5/30/2022		\$59.17	\$31.48	\$90.65
Electric Lineman	5/29/2023		\$60.48	\$32.77	\$93.25
Electric Lineman	6/3/2024		\$62.07	\$33.96	\$96.03
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2021		\$47.70	\$39.51	\$87.21
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2022		\$49.70	\$39.51	\$89.21
Iron Workers	1/1/2020		\$49.80	\$34.41	\$84.21
Ironworker (Rodman)	7/1/2020		\$44.82	\$31.60	\$76.42
Laborers (Class 01 - See notes)	5/1/2021		\$36.20	\$25.65	\$61.85
Laborers (Class 01 - See notes)	5/1/2022		\$36.30	\$27.20	\$63.50
Laborers (Class 02 - See notes)	5/1/2021		\$36.40	\$25.65	\$62.05
Laborers (Class 02 - See notes)	5/1/2022		\$36.50	\$27.20	\$63.70
Laborers (Class 03 - See notes)	5/1/2021		\$36.40	\$25.65	\$62.05
Laborers (Class 03 - See notes)	5/1/2022		\$36.50	\$27.20	\$63.70
Laborers (Class 04 - See notes)	5/1/2021		\$31.00	\$25.65	\$56.65
Laborers (Class 04 - See notes)	5/1/2022		\$31.10	\$27.20	\$58.30
Laborers (Class 05 - See notes)	5/1/2021		\$37.05	\$25.65	\$62.70
Laborers (Class 05 - See notes)	5/1/2022		\$37.15	\$27.20	\$64.35
Laborers (Class 06 - See notes)	5/1/2021		\$37.10	\$25.65	\$62.75
Laborers (Class 06 - See notes)	5/1/2022		\$37.20	\$27.20	\$64.40
Laborers (Class 07 - See notes)	5/1/2021		\$36.95	\$25.65	\$62.60
Laborers (Class 07 - See notes)	5/1/2022		\$37.05	\$27.20	\$64.25
Laborers (Class 08 - See notes)	5/1/2021		\$36.70	\$25.65	\$62.35
Laborers (Class 08 - See notes)	5/1/2022		\$36.80	\$27.20	\$64.00
Laborers (Class 09 - See notes)	5/1/2021		\$36.55	\$25.65	\$62.20
Laborers (Class 09 - See notes)	5/1/2022		\$36.65	\$27.20	\$63.85
Laborers (Class 10- See notes)	5/1/2021		\$36.70	\$25.65	\$62.35
Laborers (Class 10- See notes)	5/1/2022		\$36.80	\$27.20	\$64.00
Laborers (Class 11 -See Notes)	5/1/2021		\$36.50	\$25.65	\$62.15
Laborers (Class 11 -See Notes)	5/1/2022		\$36.70	\$27.20	\$63.90
Laborers (Class 12 -See Notes)	5/1/2021		\$37.40	\$25.65	\$63.05
Laborers (Class 12 -See Notes)	5/1/2022		\$38.40	\$27.20	\$65.60
Laborers (Class 13 -See Notes)	5/1/2021		\$40.33	\$25.65	\$65.98
Laborers (Class 13 -See Notes)	5/1/2022		\$40.43	\$27.20	\$67.63
Laborers (Class 14 -See Notes)	5/1/2021		\$36.45	\$25.65	\$62.10
Laborers (Class 14 -See Notes)	5/1/2022		\$36.55	\$27.20	\$63.75
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2017		\$23.52	\$17.58	\$41.10
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2022		\$30.17	\$19.18	\$49.35
Laborers Utility (PGW ONLY)	5/1/2017		\$30.55	\$17.58	\$48.13
Laborers Utility (PGW ONLY)	5/1/2022		\$37.20	\$19.18	\$56.38
Landscape Laborer	5/1/2020		\$26.13	\$22.95	\$49.08
Landscape Laborer	5/1/2022		\$27.73	\$23.65	\$51.38

BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 22-08288 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2021		\$49.50	\$31.51	\$81.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2022		\$51.04	\$31.97	\$83.01
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2021		\$52.51	\$32.39	\$84.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2022		\$54.05	\$32.85	\$86.90
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2021		\$49.25	\$31.44	\$80.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2022		\$50.79	\$31.90	\$82.69
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2021		\$52.27	\$32.31	\$84.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2022		\$53.81	\$32.77	\$86.58
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2021		\$45.16	\$30.24	\$75.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2022		\$46.71	\$30.69	\$77.40
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2021		\$44.86	\$30.15	\$75.01
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2022		\$46.41	\$30.60	\$77.01
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2021		\$43.14	\$29.64	\$72.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2022		\$44.69	\$30.09	\$74.78
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2021		\$42.16	\$29.34	\$71.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2022		\$43.70	\$29.80	\$73.50
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2021		\$60.00	\$36.21	\$96.21
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2022		\$61.86	\$36.75	\$98.61
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2021		\$59.72	\$36.11	\$95.83
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2022		\$61.57	\$36.66	\$98.23
Painters Class 2 (see notes)	2/1/2021		\$47.56	\$29.35	\$76.91
Painters Class 2 (see notes)	2/1/2022		\$48.62	\$30.29	\$78.91
Painters Class 3 (see notes)	2/1/2021		\$58.52	\$29.39	\$87.91
Painters Class 3 (see notes)	2/1/2022		\$59.58	\$30.33	\$89.91
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2022		\$61.34	\$40.28	\$101.62
Steamfitters	5/1/2018		\$56.37	\$34.39	\$90.76
Truckdriver class 1(see notes)	5/1/2021		\$36.33	\$17.96	\$54.29
Truckdriver class 2 (see notes)	5/1/2021		\$36.43	\$17.96	\$54.39
Truckdriver class 3 (see notes)	5/1/2021		\$36.68	\$17.96	\$54.64

Appendix A

SUPPLEMENTAL CONTRACT FORMS

Appendix B

CONDITIONS OF CONTRACT

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project Name:	Media Station Road
Awarding Agency:	Delaware County Public Works
Contract Award Date:	6/1/2020
Serial Number:	20-02538
Project Classification:	Highway
Determination Date:	3/23/2020
Assigned Field Office:	Philadelphia
Field Office Phone Number:	(215)560-1858
Toll Free Phone Number:	
Project County:	Delaware County

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 20-02538 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Asbestos & Insulation Workers	5/29/2017		\$47.30	\$34.85	\$82.15
Asbestos & Insulation Workers	5/1/2018		\$49.30	\$35.85	\$85.15
Asbestos & Insulation Workers	5/1/2019		\$51.20	\$36.95	\$88.15
Boilermaker (Commercial, Institutional, and Minor Repair Work)	3/1/2017		\$28.52	\$18.22	\$46.74
Boilermaker (Commercial, Institutional, and Minor Repair Work)	3/1/2018		\$29.52	\$18.22	\$47.74
Boilermaker (Commercial, Institutional, and Minor Repair Work)	1/1/2019		\$29.26	\$18.48	\$47.74
Boilermakers	1/1/2018		\$46.26	\$33.36	\$79.62
Boilermakers	3/1/2018		\$45.89	\$33.73	\$79.62
Boilermakers	1/1/2019		\$45.51	\$34.11	\$79.62
Boilermakers	8/1/2019		\$47.21	\$34.11	\$81.32
Bricklayer	5/1/2017		\$40.98	\$26.78	\$67.76
Bricklayer	5/1/2018		\$43.73	\$26.78	\$70.51
Bricklayer	5/1/2019		\$46.48	\$26.78	\$73.26
Carpenter - Chief of Party (Surveying & Layout)	5/1/2017		\$45.25	\$27.59	\$72.84
Carpenter - Chief of Party (Surveying & Layout)	5/1/2018	4/30/2019	\$45.83	\$27.59	\$73.42
Carpenter - Chief of Party (Surveying & Layout)	5/1/2019		\$46.54	\$27.59	\$74.13
Carpenter - Chief of Party (Surveying & Layout)	5/1/2020		\$47.73	\$27.59	\$75.32
Carpenter - Instrument Person (Surveying & Layout)	5/1/2017		\$39.35	\$27.59	\$66.94
Carpenter - Instrument Person (Surveying & Layout)	5/1/2018	4/30/2019	\$39.85	\$27.59	\$67.44
Carpenter - Instrument Person (Surveying & Layout)	5/1/2019		\$40.47	\$27.59	\$68.06
Carpenter - Instrument Person (Surveying & Layout)	5/1/2020		\$41.50	\$27.59	\$69.09
Carpenter - Rodman (Surveying & Layout)	5/1/2017		\$19.68	\$19.64	\$39.32
Carpenter - Rodman (Surveying & Layout)	5/1/2018	4/30/2019	\$19.93	\$19.49	\$39.42
Carpenter - Rodman (Surveying & Layout)	5/1/2019		\$20.24	\$19.69	\$39.93
Carpenter - Rodman (Surveying & Layout)	5/1/2020		\$20.75	\$19.49	\$40.24
Carpenters	5/1/2017		\$39.35	\$27.59	\$66.94
Carpenters	5/1/2018	4/30/2019	\$39.85	\$27.59	\$67.44
Carpenters	5/1/2019	4/30/2020	\$40.87	\$27.59	\$68.46
Carpenters	5/1/2020		\$41.90	\$27.59	\$69.49
Cement Masons	5/1/2017		\$36.45	\$31.76	\$68.21
Cement Masons	5/1/2018		\$37.50	\$32.26	\$69.76
Cement Masons	5/1/2019		\$38.50	\$32.81	\$71.31
DockBuilder/Pile Drivers (Building, Heavy & Highway)	5/1/2018		\$43.45	\$34.47	\$77.92
Dockbuilder/Piledriver (Building, Heavy, Highway)	11/1/2017		\$43.45	\$33.22	\$76.67
Dockbuilder/Piledriver (Building, Heavy, Highway)	5/1/2018		\$44.70	\$33.22	\$77.92
Drywall Finisher	5/1/2017		\$37.11	\$26.75	\$63.86
Drywall Finisher	5/1/2018		\$39.27	\$27.49	\$66.76
Drywall Finisher	5/1/2019		\$37.75	\$28.11	\$65.86
Electricians	4/30/2017		\$56.50	\$36.24	\$92.74
Electricians	4/29/2018		\$58.33	\$37.41	\$95.74
Electricians	4/29/2019		\$59.79	\$38.95	\$98.74
Elevator Constructor	1/1/2018		\$55.76	\$33.05	\$88.81

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 20-02538 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Elevator Constructor	1/1/2020		\$59.44	\$35.25	\$94.69
Floor Coverer	5/1/2019		\$44.37	\$28.44	\$72.81
Floor Coverer	5/1/2020		\$46.01	\$28.44	\$74.45
Floor Layer	5/1/2017		\$42.51	\$27.91	\$70.42
Floor Layer	5/1/2018		\$43.11	\$28.09	\$71.20
Glazier	5/1/2017		\$41.30	\$31.80	\$73.10
Glazier	5/1/2018		\$43.32	\$32.33	\$75.65
Glazier	5/1/2019		\$43.87	\$33.38	\$77.25
Interior Finish	5/1/2019		\$30.20	\$25.80	\$56.00
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2017		\$47.30	\$32.91	\$80.21
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2018		\$51.46	\$30.60	\$82.06
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2019		\$49.30	\$34.41	\$83.71
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	1/1/2020		\$49.80	\$34.41	\$84.21
Iron Workers (Riggers)	7/1/2017		\$39.83	\$27.92	\$67.75
Ironworker (Rodman)	7/1/2017		\$42.56	\$29.30	\$71.86
Ironworker (Rodman)	7/1/2018		\$42.88	\$30.60	\$73.48
Ironworker (Rodman)	7/1/2019		\$43.88	\$30.85	\$74.73
Laborers (Class 01 - General)	5/1/2020		\$32.05	\$25.25	\$57.30
Laborers (Class 01 - See notes)	5/1/2017		\$28.65	\$24.95	\$53.60
Laborers (Class 01 - See notes)	5/1/2019		\$30.20	\$25.80	\$56.00
Laborers (Class 02 - See notes)	5/1/2017		\$30.85	\$25.65	\$56.50
Laborers (Class 02 - See notes)	5/1/2019		\$33.15	\$26.50	\$59.65
Laborers (Class 02 - see notes)	5/1/2020		\$35.15	\$26.15	\$61.30
Laborers (Class 03 - See notes)	5/1/2017		\$28.92	\$25.18	\$54.10
Laborers (Class 03 - See notes)	5/1/2019		\$30.52	\$25.98	\$56.50
Laborers (Class 03 - See notes)	5/1/2020		\$32.47	\$25.43	\$57.90
Laborers (Class 04 - See notes)	5/1/2017		\$28.95	\$24.95	\$53.90
Laborers (Class 04 - See notes)	5/1/2019		\$30.52	\$25.98	\$56.50
Laborers (Class 04 - See notes)	5/1/2020		\$32.47	\$25.43	\$57.90
Laborers (Class 05 - See notes)	5/1/2017		\$28.65	\$24.95	\$53.60
Laborers (Class 05 - See notes)	5/1/2019		\$30.20	\$25.80	\$56.00
Laborers (Class 05 - See notes)	5/1/2020		\$32.05	\$25.25	\$57.30
Landscape Laborer	5/1/2017		\$22.71	\$23.08	\$45.79
Landscape Laborer	5/1/2019		\$24.64	\$23.68	\$48.32
Landscape Laborer	5/1/2020		\$26.55	\$23.13	\$49.68
Marble Finisher	5/1/2017		\$35.55	\$24.17	\$59.72
Marble Finisher	5/1/2018		\$37.55	\$24.17	\$61.72
Marble Finisher	5/1/2019		\$39.75	\$24.17	\$63.92
Marble Mason	5/1/2017		\$40.36	\$26.99	\$67.35
Marble Mason	5/1/2018		\$43.11	\$26.99	\$70.10
Marble Mason	5/1/2019		\$45.86	\$26.99	\$72.85
Mason Tender, Cement	5/1/2019		\$30.52	\$25.98	\$56.50

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 20-02538 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Millwright	7/1/2017		\$41.35	\$32.24	\$73.59
Millwright	5/1/2018		\$43.33	\$32.96	\$76.29
Millwright	5/1/2019		\$45.50	\$33.29	\$78.79
Operators (Building, Class 01 - See Notes)	5/1/2017		\$44.87	\$28.14	\$73.01
Operators (Building, Class 01 - See Notes)	5/1/2018		\$46.41	\$28.60	\$75.01
Operators (Building, Class 01 - See Notes)	5/1/2019		\$46.41	\$30.60	\$77.01
Operators (Building, Class 01 - See Notes)	5/1/2020		\$47.96	\$31.05	\$79.01
Operators (Building, Class 01 - See Notes)	5/1/2021		\$49.50	\$31.51	\$81.01
Operators (Building, Class 01A - See Notes)	5/1/2017		\$47.86	\$29.03	\$76.89
Operators (Building, Class 01A - See Notes)	5/1/2018		\$49.41	\$29.49	\$78.90
Operators (Building, Class 01A - See Notes)	5/1/2019		\$49.41	\$31.49	\$80.90
Operators (Building, Class 01A - See Notes)	5/1/2020		\$50.96	\$31.94	\$82.90
Operators (Building, Class 01A - See Notes)	5/1/2021		\$52.51	\$32.39	\$84.90
Operators (Building, Class 02 - See Notes)	5/1/2017		\$44.62	\$28.07	\$72.69
Operators (Building, Class 02 - See Notes)	5/1/2018		\$46.16	\$28.53	\$74.69
Operators (Building, Class 02 - See Notes)	5/1/2019		\$46.16	\$30.53	\$76.69
Operators (Building, Class 02 - See Notes)	5/1/2020		\$47.71	\$30.98	\$78.69
Operators (Building, Class 02 - See Notes)	5/1/2021		\$49.25	\$31.44	\$80.69
Operators (Building, Class 02A - See Notes)	5/1/2017		\$47.61	\$28.97	\$76.58
Operators (Building, Class 02A - See Notes)	5/1/2018		\$49.16	\$29.42	\$78.58
Operators (Building, Class 02A - See Notes)	5/1/2019		\$49.17	\$31.41	\$80.58
Operators (Building, Class 02A - See Notes)	5/1/2020		\$50.71	\$31.87	\$82.58
Operators (Building, Class 02A - See Notes)	5/1/2021		\$52.26	\$32.32	\$84.58
Operators (Building, Class 03 - See Notes)	5/1/2017		\$40.53	\$26.87	\$67.40
Operators (Building, Class 03 - See Notes)	5/1/2018		\$42.07	\$27.33	\$69.40
Operators (Building, Class 03 - See Notes)	5/1/2019		\$42.08	\$29.32	\$71.40
Operators (Building, Class 03 - See Notes)	5/1/2020		\$43.62	\$29.78	\$73.40
Operators (Building, Class 03 - See Notes)	5/1/2021		\$45.16	\$30.24	\$75.40
Operators (Building, Class 04 - See Notes)	5/1/2017		\$40.24	\$26.78	\$67.02
Operators (Building, Class 04 - See Notes)	5/1/2018		\$41.78	\$27.22	\$69.00
Operators (Building, Class 04 - See Notes)	5/1/2019		\$41.78	\$29.23	\$71.01
Operators (Building, Class 04 - See Notes)	5/1/2020		\$43.32	\$29.69	\$73.01
Operators (Building, Class 04 - See Notes)	5/1/2021		\$44.87	\$30.14	\$75.01
Operators (Building, Class 05 - See Notes)	5/1/2017		\$38.51	\$26.27	\$64.78
Operators (Building, Class 05 - See Notes)	5/1/2018		\$40.05	\$26.73	\$66.78
Operators (Building, Class 05 - See Notes)	5/1/2019		\$40.06	\$28.72	\$68.78
Operators (Building, Class 05 - See Notes)	5/1/2020		\$41.60	\$29.18	\$70.78
Operators (Building, Class 05 - See Notes)	5/1/2021		\$43.14	\$29.64	\$72.78
Operators (Building, Class 06 - See Notes)	5/1/2017		\$37.52	\$25.98	\$63.50
Operators (Building, Class 06 - See Notes)	5/1/2018		\$39.07	\$26.43	\$65.50
Operators (Building, Class 06 - See Notes)	5/1/2019		\$39.07	\$28.43	\$67.50
Operators (Building, Class 06 - See Notes)	5/1/2020		\$40.61	\$28.89	\$69.50
Operators (Building, Class 06 - See Notes)	5/1/2021		\$42.16	\$29.34	\$71.50
Operators (Building, Class 07A- See Notes)	5/1/2017		\$54.14	\$32.47	\$86.61

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 20-02538 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators (Building, Class 07A- See Notes)	5/1/2018		\$55.99	\$33.02	\$89.01
Operators (Building, Class 07A- See Notes)	5/1/2019		\$56.30	\$35.11	\$91.41
Operators (Building, Class 07A- See Notes)	5/1/2020		\$58.16	\$35.65	\$93.81
Operators (Building, Class 07A- See Notes)	5/1/2021		\$60.00	\$36.21	\$96.21
Operators (Building, Class 07B- See Notes)	5/1/2017		\$53.84	\$32.40	\$86.24
Operators (Building, Class 07B- See Notes)	5/1/2018		\$55.70	\$32.92	\$88.62
Operators (Building, Class 07B- See Notes)	5/1/2019		\$56.00	\$35.03	\$91.03
Operators (Building, Class 07B- See Notes)	5/1/2020		\$57.86	\$35.57	\$93.43
Operators (Building, Class 07B- See Notes)	5/1/2021		\$59.72	\$36.11	\$95.83
Painters Class 1 (see notes)	5/1/2017		\$37.82	\$26.46	\$64.28
Painters Class 1 (see notes)	5/1/2018		\$38.64	\$27.64	\$66.28
Painters Class 1 (see notes)	5/1/2019		\$39.04	\$28.99	\$68.03
Painters Class 1 (see notes)	2/1/2020		\$46.16	\$28.75	\$74.91
Painters Class 2 (see notes)	2/1/2017		\$53.67	\$26.09	\$79.76
Painters Class 2 (see notes)	2/1/2018		\$54.14	\$27.27	\$81.41
Painters Class 2 (see notes)	2/1/2019		\$55.52	\$28.39	\$83.91
Painters Class 2 (see notes)	2/1/2020		\$57.12	\$28.79	\$85.91
Plasterers	5/2/2017		\$37.42	\$28.83	\$66.25
Plasterers	5/1/2018		\$37.42	\$30.04	\$67.46
Plasterers	5/1/2019		\$37.72	\$30.74	\$68.46
plumber	5/1/2018		\$53.45	\$33.54	\$86.99
plumber	5/1/2019		\$55.45	\$34.54	\$89.99
Plumbers	5/1/2017		\$51.42	\$32.57	\$83.99
Pointers, Caulkers, Cleaners	5/1/2017		\$42.26	\$25.69	\$67.95
Pointers, Caulkers, Cleaners	5/1/2018		\$45.01	\$25.69	\$70.70
Pointers, Caulkers, Cleaners	5/1/2019		\$47.76	\$25.69	\$73.45
Roofers (Composition)	5/1/2017		\$36.15	\$30.22	\$66.37
Roofers (Composition)	5/1/2018		\$37.15	\$31.27	\$68.42
Roofers (Composition)	5/1/2019		\$38.35	\$31.80	\$70.15
Roofers (Shingle)	5/1/2016		\$25.70	\$19.17	\$44.87
Roofers (Shingle)	5/1/2019		\$28.50	\$20.87	\$49.37
Roofers (Slate & Tile)	5/1/2018		\$30.50	\$20.37	\$50.87
Roofers (Slate & Tile)	5/1/2019		\$31.50	\$20.87	\$52.37
Sheet Metal Workers	5/1/2017		\$46.42	\$39.51	\$85.93
Sheet Metal Workers	5/1/2018		\$47.58	\$41.60	\$89.18
Sheet Metal Workers	5/1/2019		\$49.79	\$42.89	\$92.68
Sprinklerfitters	1/1/2018		\$53.65	\$26.22	\$79.87
Sprinklerfitters	5/1/2019		\$57.20	\$28.32	\$85.52
Steamfitters	5/1/2017		\$54.64	\$32.53	\$87.17
Steamfitters	5/1/2018		\$56.37	\$34.39	\$90.76
Steamfitters	5/1/2019		\$58.17	\$35.99	\$94.16
Stone Masons	5/1/2017		\$40.36	\$26.99	\$67.35
Stone Masons	5/1/2018		\$43.11	\$26.99	\$70.10
Stone Masons	5/1/2019		\$45.86	\$26.99	\$72.85

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 20-02538 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Terrazzo Finisher	5/1/2017		\$39.06	\$22.73	\$61.79
Terrazzo Finisher	5/1/2018		\$41.31	\$22.73	\$64.04
Terrazzo Finisher	5/1/2019		\$43.61	\$22.73	\$66.34
Terrazzo Grinder	5/1/2017		\$39.33	\$22.73	\$62.06
Terrazzo Grinder	5/1/2018		\$41.58	\$22.73	\$64.31
Terrazzo Grinder	5/1/2019		\$43.88	\$22.73	\$66.61
Terrazzo Mechanics	5/1/2017		\$43.71	\$24.81	\$68.52
Terrazzo Mechanics	5/1/2018		\$46.46	\$24.81	\$71.27
Terrazzo Mechanics	5/1/2019		\$49.21	\$24.81	\$74.02
Tile Finisher	5/1/2017		\$35.55	\$24.17	\$59.72
Tile Finisher	5/1/2018		\$37.55	\$24.17	\$61.72
Tile Finisher	5/1/2019		\$39.75	\$24.17	\$63.92
Tile Setter	5/1/2017		\$43.71	\$24.81	\$68.52
Tile Setter	5/1/2018		\$46.46	\$24.81	\$71.27
Tile Setter	5/1/2019		\$49.21	\$24.81	\$74.02
Truckdriver class 1(see notes)	5/1/2017		\$30.46	\$17.96	\$48.42
Truckdriver class 1(see notes)	5/1/2018		\$31.93	\$17.96	\$49.89
Truckdriver class 1(see notes)	5/1/2019		\$32.21	\$19.19	\$51.40
Truckdriver class 1(see notes)	5/1/2020		\$34.93	\$17.96	\$52.89
Truckdriver class 1(see notes)	5/1/2021		\$36.48	\$17.96	\$54.44
Truckdriver class 2 (see notes)	5/1/2017		\$30.56	\$17.96	\$48.52
Truckdriver class 2 (see notes)	5/1/2018		\$32.03	\$17.96	\$49.99
Truckdriver class 2 (see notes)	5/1/2019		\$32.31	\$19.19	\$51.50
Truckdriver class 2 (see notes)	5/1/2020		\$35.03	\$17.96	\$52.99
Truckdriver class 2 (see notes)	5/1/2021		\$36.58	\$17.96	\$54.54
Truckdriver class 3 (see notes)	5/1/2017		\$30.81	\$17.96	\$48.77
Truckdriver class 3 (see notes)	5/1/2018		\$32.28	\$17.96	\$50.24
Truckdriver class 3 (see notes)	5/1/2019		\$32.56	\$19.19	\$51.75
Truckdriver class 3 (see notes)	5/1/2020		\$35.28	\$17.96	\$53.24
Truckdriver class 3 (see notes)	5/1/2021		\$36.83	\$17.96	\$54.79
Window Film / Tint Installer	6/1/2019		\$24.52	\$12.08	\$36.60

BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 20-02538 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Carpenter - Chief of Party (Surveying & Layout)	5/1/2017		\$51.42	\$27.39	\$78.81
Carpenter - Chief of Party (Surveying & Layout)	5/1/2018	4/30/2019	\$53.20	\$27.69	\$80.89
Carpenter - Chief of Party (Surveying & Layout)	5/1/2019	4/30/2020	\$55.38	\$27.69	\$83.07
Carpenter - Chief of Party (Surveying & Layout)	5/1/2020	4/30/2021	\$57.63	\$27.69	\$85.32
Carpenter - Chief of Party (Surveying & Layout)	5/1/2021		\$59.93	\$27.69	\$87.62
Carpenter - Instrument Person (Surveying & Layout)	5/1/2017		\$44.71	\$27.39	\$72.10
Carpenter - Instrument Person (Surveying & Layout)	5/1/2018	4/30/2019	\$46.26	\$27.69	\$73.95
Carpenter - Instrument Person (Surveying & Layout)	5/1/2019	4/30/2020	\$48.16	\$27.69	\$75.85
Carpenter - Instrument Person (Surveying & Layout)	5/1/2020	4/30/2021	\$50.11	\$27.69	\$77.80
Carpenter - Instrument Person (Surveying & Layout)	5/1/2021		\$52.11	\$27.69	\$79.80
Carpenter - Rodman (Surveying & Layout)	5/1/2017		\$35.77	\$21.19	\$56.96
Carpenter - Rodman (Surveying & Layout)	5/1/2018	4/30/2019	\$37.01	\$21.34	\$58.35
Carpenter - Rodman (Surveying & Layout)	5/1/2019	4/30/2020	\$38.53	\$21.34	\$59.87
Carpenter - Rodman (Surveying & Layout)	5/1/2020	4/30/2021	\$40.09	\$21.34	\$61.43
Carpenter - Rodman (Surveying & Layout)	5/1/2021		\$41.69	\$21.34	\$63.03
Carpenter	5/1/2018	4/30/2019	\$46.26	\$27.69	\$73.95
Carpenter	5/1/2019	4/30/2020	\$47.81	\$28.04	\$75.85
Carpenter	5/1/2020	4/30/2021	\$49.76	\$28.04	\$77.80
Carpenter	5/1/2021		\$51.76	\$28.04	\$79.80
Carpenters	5/1/2017		\$44.71	\$27.39	\$72.10
Carpenters	5/1/2018		\$46.56	\$27.39	\$73.95
Carpenters	5/1/2019		\$48.46	\$27.39	\$75.85
Carpenters	5/1/2020		\$50.41	\$27.39	\$77.80
Carpenters	5/1/2021		\$52.41	\$27.39	\$79.80
Cement Masons	5/1/2017		\$34.45	\$31.51	\$65.96
Cement Masons	5/1/2018		\$35.65	\$32.01	\$67.66
Cement Masons	5/1/2019		\$37.90	\$31.51	\$69.41
Cement Masons	5/1/2020		\$39.70	\$31.51	\$71.21
Cement Masons	5/1/2021		\$41.55	\$31.51	\$73.06
Electric Lineman	5/29/2017		\$52.60	\$26.37	\$78.97
Electric Lineman	5/28/2018		\$53.64	\$27.45	\$81.09
Electric Lineman	5/27/2019		\$54.66	\$28.56	\$83.22
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	1/1/2017		\$46.20	\$31.26	\$77.46
Iron Workers	7/1/2017		\$47.30	\$32.91	\$80.21
Iron Workers	7/1/2019		\$49.30	\$34.41	\$83.71
Iron Workers	1/1/2020		\$49.80	\$34.41	\$84.21
Laborers (Class 01 - See notes)	5/1/2017		\$29.75	\$25.65	\$55.40
Laborers (Class 01 - See notes)	5/1/2018		\$31.25	\$25.65	\$56.90
Laborers (Class 01 - See notes)	5/1/2019		\$31.95	\$26.50	\$58.45
Laborers (Class 01 - See notes)	5/1/2020		\$33.95	\$26.15	\$60.10
Laborers (Class 01 - See notes)	5/1/2021		\$36.20	\$25.65	\$61.85
Laborers (Class 02 - See notes)	5/1/2017		\$29.95	\$25.65	\$55.60
Laborers (Class 02 - See notes)	5/1/2018		\$31.45	\$25.65	\$57.10
Laborers (Class 02 - See notes)	5/1/2019		\$32.15	\$26.50	\$58.65

BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 20-02538 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Laborers (Class 02 - See notes)	5/1/2020		\$34.15	\$26.15	\$60.30
Laborers (Class 02 - See notes)	5/1/2021		\$36.40	\$25.65	\$62.05
Laborers (Class 03 - See notes)	5/1/2017		\$29.95	\$25.65	\$55.60
Laborers (Class 03 - See notes)	5/1/2018		\$31.45	\$25.65	\$57.10
Laborers (Class 03 - See notes)	5/1/2019		\$32.15	\$26.50	\$58.65
Laborers (Class 03 - See notes)	5/1/2020		\$34.15	\$26.15	\$60.30
Laborers (Class 03 - See notes)	5/1/2021		\$36.40	\$25.65	\$62.05
Laborers (Class 04 - See notes)	5/1/2017		\$24.55	\$25.65	\$50.20
Laborers (Class 04 - See notes)	5/1/2018		\$26.05	\$25.65	\$51.70
Laborers (Class 04 - See notes)	5/1/2019		\$26.75	\$26.50	\$53.25
Laborers (Class 04 - See notes)	5/1/2020		\$28.75	\$26.15	\$54.90
Laborers (Class 04 - See notes)	5/1/2021		\$31.00	\$25.65	\$56.65
Laborers (Class 05 - See notes)	5/1/2017		\$30.60	\$25.65	\$56.25
Laborers (Class 05 - See notes)	5/1/2018		\$32.10	\$25.65	\$57.75
Laborers (Class 05 - See notes)	5/1/2019		\$32.80	\$26.50	\$59.30
Laborers (Class 05 - See notes)	5/1/2020		\$34.80	\$26.15	\$60.95
Laborers (Class 05 - See notes)	5/1/2021		\$37.05	\$25.65	\$62.70
Laborers (Class 06 - See notes)	5/1/2017		\$30.65	\$25.65	\$56.30
Laborers (Class 06 - See notes)	5/1/2018		\$32.15	\$25.65	\$57.80
Laborers (Class 06 - See notes)	5/1/2019		\$32.85	\$26.50	\$59.35
Laborers (Class 06 - See notes)	5/1/2020		\$34.85	\$26.15	\$61.00
Laborers (Class 06 - See notes)	5/1/2021		\$37.10	\$25.65	\$62.75
Laborers (Class 07 - See notes)	5/1/2017		\$30.50	\$25.65	\$56.15
Laborers (Class 07 - See notes)	5/1/2018		\$32.00	\$25.65	\$57.65
Laborers (Class 07 - See notes)	5/1/2019		\$32.70	\$26.50	\$59.20
Laborers (Class 07 - See notes)	5/1/2020		\$34.70	\$26.15	\$60.85
Laborers (Class 07 - See notes)	5/1/2021		\$36.95	\$25.65	\$62.60
Laborers (Class 08 - See notes)	5/1/2017		\$30.25	\$25.65	\$55.90
Laborers (Class 08 - See notes)	5/1/2018		\$31.75	\$25.65	\$57.40
Laborers (Class 08 - See notes)	5/1/2019		\$32.45	\$26.50	\$58.95
Laborers (Class 08 - See notes)	5/1/2020		\$34.45	\$26.15	\$60.60
Laborers (Class 08 - See notes)	5/1/2021		\$36.70	\$25.65	\$62.35
Laborers (Class 09 - See notes)	5/1/2017		\$30.10	\$25.65	\$55.75
Laborers (Class 09 - See notes)	5/1/2018		\$31.60	\$25.65	\$57.25
Laborers (Class 09 - See notes)	5/1/2019		\$32.30	\$26.50	\$58.80
Laborers (Class 09 - See notes)	5/1/2020		\$34.30	\$26.15	\$60.45
Laborers (Class 09 - See notes)	5/1/2021		\$36.55	\$25.65	\$62.20
Laborers (Class 10- See notes)	5/1/2017		\$30.25	\$25.65	\$55.90
Laborers (Class 10- See notes)	5/1/2018		\$33.30	\$25.65	\$58.95
Laborers (Class 10- See notes)	5/1/2019		\$32.45	\$26.50	\$58.95
Laborers (Class 10- See notes)	5/1/2020		\$34.45	\$26.15	\$60.60
Laborers (Class 10- See notes)	5/1/2021		\$36.70	\$25.65	\$62.35
Laborers (Class 11 -See Notes)	5/1/2017		\$30.15	\$25.65	\$55.80
Laborers (Class 11 -See Notes)	5/1/2018		\$31.55	\$25.65	\$57.20

BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 20-02538 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Laborers (Class 11 -See Notes)	5/1/2019		\$32.35	\$26.50	\$58.85
Laborers (Class 11 -See Notes)	5/1/2020		\$34.35	\$26.15	\$60.50
Laborers (Class 11 -See Notes)	5/1/2021		\$36.50	\$25.65	\$62.15
Laborers (Class 12 -See Notes)	5/1/2017		\$31.85	\$25.65	\$57.50
Laborers (Class 12 -See Notes)	5/1/2018		\$32.45	\$25.65	\$58.10
Laborers (Class 12 -See Notes)	5/1/2019		\$34.05	\$26.50	\$60.55
Laborers (Class 12 -See Notes)	5/1/2020		\$36.05	\$26.15	\$62.20
Laborers (Class 12 -See Notes)	5/1/2021		\$37.40	\$25.65	\$63.05
Laborers (Class 13 -See Notes)	5/1/2017		\$33.88	\$25.65	\$59.53
Laborers (Class 13 -See Notes)	5/1/2018		\$35.38	\$25.65	\$61.03
Laborers (Class 13 -See Notes)	5/1/2019		\$36.08	\$26.50	\$62.58
Laborers (Class 13 -See Notes)	5/1/2020		\$38.08	\$26.15	\$64.23
Laborers (Class 13 -See Notes)	5/1/2021		\$40.33	\$25.65	\$65.98
Laborers (Class 14 -See Notes)	5/1/2017		\$30.00	\$25.65	\$55.65
Laborers (Class 14 -See Notes)	5/1/2018		\$31.50	\$25.65	\$57.15
Laborers (Class 14 -See Notes)	5/1/2019		\$32.20	\$26.50	\$58.70
Laborers (Class 14 -See Notes)	5/1/2020		\$34.20	\$26.15	\$60.35
Laborers (Class 14 -See Notes)	5/1/2021		\$36.45	\$25.65	\$62.10
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2017		\$23.52	\$17.58	\$41.10
Laborers Utility (PGW ONLY)	5/1/2017		\$30.55	\$17.58	\$48.13
Landscape Laborer	5/1/2016		\$21.19	\$22.65	\$43.84
Landscape Laborer	5/1/2019		\$24.22	\$23.50	\$47.72
Landscape Laborer	5/1/2020		\$26.13	\$22.95	\$49.08
Operators (Heavy, Class 05 - See Notes)	5/1/2019		\$40.06	\$28.72	\$68.78
Operators (Heavy, Class 06 - See Notes)	5/1/2019		\$39.07	\$28.43	\$67.50
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2017		\$44.87	\$28.14	\$73.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2018		\$46.41	\$28.60	\$75.01
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2017		\$47.86	\$29.03	\$76.89
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2018		\$49.41	\$29.49	\$78.90
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2017		\$44.62	\$28.07	\$72.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2018		\$46.16	\$28.53	\$74.69
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2017		\$47.61	\$28.97	\$76.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2018		\$49.16	\$29.42	\$78.58
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2017		\$40.53	\$26.87	\$67.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2018		\$42.07	\$27.33	\$69.40
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2017		\$40.24	\$26.78	\$67.02
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2018		\$41.78	\$27.22	\$69.00

**BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES**

Project: 20-02538 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Highway)					
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2017		\$38.51	\$26.27	\$64.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2018		\$40.05	\$26.73	\$66.78
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2017		\$37.52	\$25.98	\$63.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2018		\$39.07	\$26.43	\$65.50
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2017		\$54.14	\$32.47	\$86.61
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2018		\$55.99	\$33.02	\$89.01
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2017		\$53.84	\$32.40	\$86.24
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2018		\$55.70	\$32.92	\$88.62
Painters (Bridges, Stacks, Towers)	2/1/2017		\$53.67	\$26.09	\$79.76
Painters (Bridges, Stacks, Towers)	2/1/2018		\$54.14	\$27.27	\$81.41
Painters (Bridges, Stacks, Towers)	2/1/2019		\$55.52	\$28.39	\$83.91
Painters (Bridges, Stacks, Towers)	2/1/2020		\$57.12	\$28.79	\$85.91
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2017		\$51.91	\$32.53	\$84.44
Steamfitters	5/1/2018		\$56.37	\$34.39	\$90.76
Truckdriver class 1(see notes)	5/1/2017		\$30.31	\$17.96	\$48.27
Truckdriver class 1(see notes)	5/1/2018		\$31.78	\$17.96	\$49.74
Truckdriver class 1(see notes)	5/1/2019		\$32.06	\$19.19	\$51.25
Truckdriver class 1(see notes)	5/1/2020		\$34.78	\$17.96	\$52.74
Truckdriver class 1(see notes)	5/1/2021		\$36.33	\$17.96	\$54.29
Truckdriver class 2 (see notes)	5/1/2017		\$30.41	\$17.96	\$48.37
Truckdriver class 2 (see notes)	5/1/2018		\$31.88	\$17.96	\$49.84
Truckdriver class 2 (see notes)	5/1/2019		\$32.16	\$19.19	\$51.35
Truckdriver class 2 (see notes)	5/1/2020		\$34.88	\$17.96	\$52.84
Truckdriver class 2 (see notes)	5/1/2021		\$36.43	\$17.96	\$54.39
Truckdriver class 3 (see notes)	5/1/2017		\$30.66	\$17.96	\$48.62
Truckdriver class 3 (see notes)	5/1/2018		\$32.13	\$17.96	\$50.09
Truckdriver class 3 (see notes)	5/1/2019		\$32.41	\$19.19	\$51.60
Truckdriver class 3 (see notes)	5/1/2020		\$35.13	\$17.96	\$53.09
Truckdriver class 3 (see notes)	5/1/2021		\$36.68	\$17.96	\$54.64

Bidder Checklist

1. Have you carefully read and agreed to the entire bid package? Yes _____
2. Have you returned complete Bid Submittal Forms (See Instructions to Bidders, Section 4)?
Yes _____
3. Has an authorized agent of your firm signed the Signature Page of the Bid? Yes _____
4. Have you provided a Bid Bond, Certified or Cashier's Check or Cash equal to ten percent (10%) of the total bid with your bid? Yes _____
5. If you are submitting a bid bond, has it been signed by both the insurance company and an authorized official of your firm? Yes _____
6. Have you provided a signed Consent / Agreement of Surety with your Bid? Yes _____
7. Have you submitted a Non-Collusion Affidavit? Yes _____
8. Have you submitted AIA Document A305 – 1986, Contractor's Qualification Statement?
Yes _____
9. Have you included a financial statement in accordance with AIA Document A305 – 1986, Section 5.1.1? Yes _____
10. Have you submitted a Contractor Responsibility Certification in accordance with Delaware County Ordinance No. 2022-? Yes _____
11. Have you submitted a written statement describing your Apprentice Training Program?
(Special Condition No. 21) Yes _____
12. Have you submitted your Affirmative Action Program? (Special Conditions No. 22) Yes _____

AIA® Document A305™ – 1986

Contractor's Qualification Statement

The Undersigned certifies under oath that the information provided herein is true and sufficiently complete so as not to be misleading.

SUBMITTED TO:

ADDRESS:

SUBMITTED BY:

NAME:

ADDRESS:

PRINCIPAL OFFICE:

- ☐ Corporation
- ☐ Partnership
- ☐ Individual
- ☐ Joint Venture
- ☐ Other

NAME OF PROJECT: *(if applicable)* Template

TYPE OF WORK: *(file separate form for each Classification of Work)*

- ☐ General Construction
- ☐ HVAC
- ☐ Electrical
- ☐ Plumbing
- ☐ Other: *(Specify)*

§ 1 ORGANIZATION

§ 1.1 How many years has your organization been in business as a Contractor?

§ 1.2 How many years has your organization been in business under its present business name?

§ 1.2.1 Under what other or former names has your organization operated?

§ 1.3 If your organization is a corporation, answer the following:

§ 1.3.1 Date of incorporation:

§ 1.3.2 State of incorporation:

§ 1.3.3 President's name:

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 form is approved and recommended by the American Institute of Architects (AIA) and The Associated General Contractors of America (AGC) for use in evaluating the qualifications of contractors. No endorsement of the submitting party or verification of the information is made by AIA or AGC.

§ 1.3.4 Vice-president's name(s)

§ 1.3.5 Secretary's name:

§ 1.3.6 Treasurer's name:

§ 1.4 If your organization is a partnership, answer the following:

§ 1.4.1 Date of organization:

§ 1.4.2 Type of partnership (if applicable):

§ 1.4.3 Name(s) of general partner(s)

§ 1.5 If your organization is individually owned, answer the following:

§ 1.5.1 Date of organization:

§ 1.5.2 Name of owner:

§ 1.6 If the form of your organization is other than those listed above, describe it and name the principals:

§ 2 LICENSING

§ 2.1 List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.

§ 2.2 List jurisdictions in which your organization's partnership or trade name is filed.

§ 3 EXPERIENCE

§ 3.1 List the categories of work that your organization normally performs with its own forces.

§ 3.2 Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)

§ 3.2.1 Has your organization ever failed to complete any work awarded to it?

§ 3.2.2 Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

§ 3.2.3 Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years?

§ 3.3 Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is yes, please attach details.)

§ 3.4 On a separate sheet, list major construction projects your organization has in progress, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.

§ 3.4.1 State total worth of work in progress and under contract:

§ 3.5 On a separate sheet, list the major projects your organization has completed in the past five years, giving the name of project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.

§ 3.5.1 State average annual amount of construction work performed during the past five years:

§ 3.6 On a separate sheet, list the construction experience and present commitments of the key individuals of your organization.

§ 4 REFERENCES

§ 4.1 Trade References:

§ 4.2 Bank References:

§ 4.3 Surety:

§ 4.3.1 Name of bonding company:

§ 4.3.2 Name and address of agent:

§ 5 FINANCING

§ 5.1 Financial Statement.

§ 5.1.1 Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses);

Net Fixed Assets;

Other Assets;

Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes);

Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings).

§ 5.1.2 Name and address of firm preparing attached financial statement, and date thereof:

§ 5.1.3 Is the attached financial statement for the identical organization named on page one?

§ 5.1.4 If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary).

§ 5.2 Will the organization whose financial statement is attached act as guarantor of the contract for construction?

§ 6 SIGNATURE

§ 6.1 Dated at this day of

Name of Organization:

By:

Title:

§ 6.2

M being duly sworn deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

Subscribed and sworn before me this day of

Notary Public:

My Commission Expires:

Additions and Deletions Report for **AIA[®] Document A305[™] – 1986**

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 10:39:17 on 10/16/2013.

PAGE 1

NAME OF PROJECT: *(if applicable)* Template

Certification of Document's Authenticity

AIA® Document D401™ – 2003

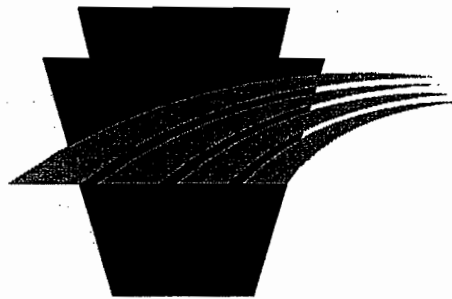
I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 10:39:17 on 10/16/2013 under Order No. 2365504816_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A305™ – 1986, Contractor's Qualification Statement, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)

(Title)

(Dated)

THE APPRENTICESHIP AND TRAINING ACT



DEPARTMENT OF
LABOR & INDUSTRY
COMMONWEALTH OF PENNSYLVANIA

BUREAU OF LABOR LAW COMPLIANCE

"THE APPRENTICESHIP AND TRAINING ACT"
Act of 1961, P.L. 604, No. 304

AN ACT

Relating to apprenticeship and training; creating a State Apprenticeship and Training Council in the Department of Labor and Industry to formulate an apprenticeship and training policy and program, and defining its powers and duties and providing for administration.

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. Declaration of Policy.

It is declared to be the policy of this act,

(1) to encourage the development of an apprenticeship and training system through the voluntary cooperation of management and labor and interested State agencies and in cooperation with other states and the Federal Government;

(2) to provide for the establishment and furtherance of standards of apprenticeship and training to safeguard the welfare of apprentices and trainees;

(3) to aid in providing maximum opportunities for unemployed and employed persons to improve and modernize their work skills; and

(4) to contribute to a healthy economy by aiding in the development and maintenance of a skilled labor force sufficient in numbers and quality to meet the expanding needs of Pennsylvania industry and to attract new industry.

Section 2. Short Title.

This act shall be known and may be cited as "The Apprenticeship and Training Act."

Section 3. State Apprenticeship and Training Council.

There is hereby created a State Apprenticeship and Training Council (hereinafter called "The Council") as a departmental agency in the Department of Labor and Industry to be composed of eleven members who shall be appointed by the Governor. Four members shall be representatives of employees and four members shall be representatives of employers and three members shall be representatives of the general public. Members of the council, other than the ex-officio members, shall be appointed for a term of four years and until their successors are appointed, except that two of the original members shall be appointed for a term of one year, two for a term of two years, and two for a term of three years, and two for a term of four years. Members of the council shall be eligible for reappointment. In case of a vacancy, the Governor shall make an appointment for the unexpired term. A Deputy Secretary of the Department of Labor and Industry, the Director of the State Employment Service of the Bureau of Employment Security of the Department of Labor and Industry, the Executive Director of the Advisory Board on Problems of Older Workers of the Department of Labor and Industry, and the Coordinator of Industrial Education of the Department of Public Instruction, and Chief of the Bureau of Rehabilitation of the Department of Labor and Industry, shall be ex-officio members of the council but shall not be entitled to vote, except that in the event of a tie vote, the Deputy Secretary of Labor and Industry shall have the right to cast the tie-breaking vote. The council shall organize immediately upon its appointment, and annually thereafter, by the election of one of its members as chairman and another as vice-chairman, one of whom shall be a representative of employees and the other a representative of employers. Each member of the State Apprenticeship and Training Council, except ex-officio members, shall receive actual traveling expenses and per diem compensation at the rate of twenty-five dollars (\$25) per day for the time actually devoted to the business of the council.

Section 4. Powers and Duties.

(a) The council shall

(1) establish standards for apprenticeship in conformity with the provisions of this act and applicable statutes and regulations of the Federal Government;

(2) adopt such rules and regulations, subject only to the approval of the Secretary of Labor and Industry, as may be necessary to carry out the intent and purpose of this act;

(3) compile such data on population and employment trends, industrial production, vocational and industrial education and job requirements as may be deemed necessary to carry out the intent and purpose of this act;

(4) to terminate or cancel any apprenticeship agreements in accordance with the provisions of such agreements or order modifications of such agreements;

(5) maintain close liaison with Bureau of Apprenticeship and Training, the United States Department of Labor, the State Board of Vocational Education, the Department of Public Instruction, the Department of Commerce, Bureau of Rehabilitation of the Department of Labor and Industry, and Juvenile Forestry Camps under the Department of Public Welfare, and such other agencies which carry on programs closely related to the purposes of this act;

(6) conduct studies, surveys and investigations of the special problems of retraining or training unemployed or employed persons to improve or modernize work skills and make appropriate recommendations to cooperating agencies described above, local community organizations, local school boards and the Secretary of Labor and Industry;

(7) act as a convening agency in local communities to bring together local representatives of employees, employers, educational agencies and industrial development agencies in order to promote closer local cooperation in establishing better apprenticeship and other training programs including programs for employed persons who wish to improve and modernize their work skills;

(8) use appropriate media of information and education to acquaint employers, employees and the public at large with the advantages and availability of apprenticeship and other occupational training programs;

(9) study the effectiveness of apprenticeship agreements and make recommendations in accordance with the provisions of such agreements for their improvement; and

(10) perform such other duties as may be necessary to give full effect to the provisions of this act.

(b) The council shall make a report to the Secretary of the Department of Labor and Industry, on or before February fifteenth, each year, indicating the extent of apprenticeship and other occupational training programs during the previous year, trends in employment requiring adjustments in apprenticeship training and other occupational programs, needs for expansion of apprenticeship and other occupational training programs, activities of the council and such recommendations as are in accord with the purposes of this act.

(c) No action affecting the status of an agreement shall be taken by the council until an attempt has been made to bring the employees and employer together to settle the problem in conformity with the standards of the council.

Compiler's Note: The Department of Commerce, referred to in subsec. (a), was renamed the Department of Community and Economic Development by Act 58 of 1996.

Section 5. Meetings.

Meetings of the council shall be held monthly and as often as is necessary in the opinion of the majority of the council. The chairman shall designate the time and place of the meetings and the secretary shall notify all council members at least one week in advance of each meeting. A majority of the voting membership of the council shall constitute a quorum if at least one representative from both the employe and employer groups is present.

Section 6. Administration.

The Secretary of the Department of Labor and Industry shall appoint a Director of Apprenticeship and Training who shall be responsible to the Secretary of Labor and Industry in carrying out the provisions of this act and who shall serve as ex-officio secretary of the council. The Secretary of the Department of Labor and Industry is authorized to appoint or make available to the Director of Apprenticeship and Training such clerical, technical and professional services necessary to the performance of his duties.

Section 7. Director Duties.

The Director of Apprenticeship and Training shall carry out the purposes of this act. His duties shall include, but shall not be limited to,

- (1) encouragement and promotion of the standards established in accordance with this act and with the basic standards of the Federal Committee on Apprenticeship;
- (2) bringing about the settlement of differences arising out of apprenticeship agreements when the differences cannot be adjusted locally or in accordance with established trade procedure;
- (3) supervision of the execution of agreements and maintenance of standards;
- (4) registration of apprenticeship agreements as the council shall authorize as conforming to the established standards;
- (5) keeping a record of apprenticeship agreements and, upon performance thereof, issuing certificates of completion of apprenticeship;
- (6) execution of the actions of the council in all of its powers and duties under section 4 of this act;
- (7) encouragement of liaison and cooperation between all private, State and Federal agencies concerned with apprenticeship, trade and industrial training;
- (8) promotion of employe, employer and public awareness of apprenticeship and other occupational training; and
- (9) keeping a record of the progress of apprenticeship and training programs initiated in accordance with the provisions of this act and informing the council periodically as to the results.

Section 8. Limitation.

The provisions of this act shall apply only to persons, copartnerships, associations, corporations and political subdivisions, and employer associations or organizations or associations of employes as voluntarily elect to conform with its provisions.

Section 9. General Repeal.

All acts or parts of acts inconsistent herewith are hereby repealed.

Section 10. This act shall become effective June 1, 1961.

STATEMENTS OF POLICY

DEPARTMENT OF GENERAL SERVICES

[4 PA. CODE CH. 66]

Guidelines for Administering and Enforcing the Public Works Employment Verification Act

[42 Pa.B. 7821]

[Saturday, December 29, 2012]

The Department of General Services (Department) adopts a statement of policy in Chapter 66 (relating to employment verification—statement of policy) to read as set forth in Annex A. Chapter 66 implements the Public Works Employment Verification Act (act) (43 P. S. §§ 167.1—167.11).

Chapter 66 establishes guidelines for administering and enforcing the act, which requires public works contractors and subcontractors performing work on public works projects in this Commonwealth to comply with the Federal E-Verify program to ensure employees are authorized to work in the United States. The E-Verify program is a free Internet-based program operated by the United States Department of Homeland Security that compares information from an employee's Form I-9, Employment Eligibility Verification, to data from the United States Department of Homeland Security and Social Security Administration records to confirm employment eligibility. The purpose of this statement of policy is to establish guidelines for administering and enforcing the act.

Fiscal Impact

Civil penalties collected in the enforcement of the act will be retained by the Department to offset the costs of administering the Pennsylvania Public Works Employment Verification Program.

Effective Date

This statement of policy is effective January 1, 2013.

Contact Person

Specific questions regarding this statement of policy should be directed to the Department of General Services, Public Works Employment Verification Compliance Office, Room 105 Tent Building, Public Works Deputate, 18th and Herr Streets, Harrisburg, PA 17125.

SHERI PHILLIPS,
Secretary

(Editor's Note: Title 4 of the Pennsylvania Code is amended by adding statements of policy in §§ 66.1—66.9 to read as set forth in Annex A.)

Fiscal Note: 8-17. This action will not result in a loss of revenue to the Commonwealth or its political subdivisions. This program may increase program costs for the administration and enforcement; however, such costs will be offset by any civil penalties collected through the enforcement of the act.

Annex A

TITLE 4. ADMINISTRATION

PART III. DEPARTMENT OF GENERAL SERVICES

Subpart C. CONSTRUCTION AND PROCUREMENT

ARTICLE II. CONSTRUCTION

CHAPTER 66. EMPLOYMENT VERIFICATION—STATEMENT OF POLICY

Sec.

- 66.1. Background and purpose.
- 66.2. Scope of work subject to the act.
- 66.3. Definitions.
- 66.4. General requirements for public works contractors and subcontractors.
- 66.5. Specific requirements for public works contractors.
- 66.6. Specific requirements for public works subcontractors.
- 66.7. Public Works Employment Verification Form.
- 66.8. Violations.
- 66.9. Enforcement.

§ 66.1. Background and purpose.

(a) To prevent unauthorized employment, the Federal government created the EVP system to ensure that companies employ a legal workforce. The EVP system is an Internet-based system operated by the United States Department of Homeland Security that compares information from an employee's Form I-9, Employment Eligibility Verification, to data from United States Department of Homeland Security and Social Security Administration records to confirm employment eligibility.

(b) The purpose of this chapter is to set forth the Department's policy guidelines for the scope, administration and enforcement of the act.

(c) The Department is responsible to implement the Commonwealth's process of notification, investigation and compliance with the act. Contractors and subcontractors performing work on a public works project shall comply with the act as set forth in this chapter by utilizing the EVP.

§ 66.2. Scope of work subject to the act.

(a) The act applies to public works contractors and subcontractors performing on a public works contract paid for in whole or in part out of the funds of a public body when the cost of the total project is in excess of \$25,000.

(b) The cost of the total project must include the sum of prime contracts to be issued by the public body for the project.

(c) To the extent the cost of the total project is in excess of \$25,000, contracts and subcontracts, regardless of value, shall comply with the act.

(d) The act does not apply to work performed under a manpower or rehabilitation training program.

§ 66.3. Definitions.

The following words and terms, when used in this chapter, have the following meanings, unless the context clearly indicates otherwise:

Act—The Public Works Employment Verification Act (43 P. S. §§ 167.1—167.11).

Contract—A type of written agreement, regardless of what it may be called, for the procurement of construction work.

Department—The Department of General Services of the Commonwealth.

EVP—E-Verify program—The program operated by the United States Department of Homeland Security that electronically verifies employment eligibility.

Employee—An individual hired by a public works contractor or a subcontractor after January 1, 2013, for whom a public works contractor or subcontractor is required by law to file a Form W-2 with the Internal Revenue Service.

Form—Public Works Employment Verification Form.

Maintenance work—Annual inspection or routine upkeep of an existing facility which does not alter the use or size of the facility.

Public body—The Commonwealth of Pennsylvania, its political subdivisions, authorities created by the General Assembly of the Commonwealth and instrumentalities or agencies of the Commonwealth.

Public works—

(i) The construction, reconstruction, demolition, alteration 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 when the estimated cost of the total project is in excess of \$25,000.

(ii) The term does not include work performed under a manpower or rehabilitation training program.

Public works contractor—A contractor that provides work under a contract involving public works.

Secretary—The Secretary of the Department.

Subcontractor—

(i) A person, other than a natural person, including a staffing agency, that performs work for a public works contractor under a contract for public works.

(ii) The term includes subcontractors of every level, that is, sub-subcontractors, sub-sub-subcontractors, and the like.

(iii) The term does not include persons that supply materials for a project.

Willful—An action or conduct undertaken intentionally or with reckless disregard for or deliberate ignorance of the requirements and obligations established under the act.

§ 66.4. General requirements for public works contractors and subcontractors.

(a) Public works contractors and every subcontractor performing work under a public works contract shall utilize the EVP system to verify the employment eligibility of each new employee hired after January 1, 2013.

(b) Public works contractors and every subcontractor performing work under a public works contract shall submit the Form to the contracting public body to ensure compliance with the act.

(c) In addition to the Form, public works contractors and every subcontractor shall maintain documentation of continued compliance with the act by utilizing the EVP for new employees hired throughout the duration of the public work contract.

§ 66.5. Specific requirements for public works contractors.

(a) As a precondition to the award of a contract for public work, a public works contractor shall submit a completed Form to the public body that is bidding and awarding the public work contract. With respect to a contract that has been awarded but has not been fully executed as of January 1, 2013, a public works contractor is required to submit a completed Form to the contracting public body prior to contract execution. During a public works contract, a new employee hired by a public works contractor, regardless of whether he will be working onsite or offsite of a public work or otherwise, shall be verified within 5 business days of his start date.

(b) Subcontracts between a public works contractor and its subcontractors are required to contain notification of the applicability of the act, information regarding the use of EVP and reference to the Department's web site at www.dgs.state.pa.us to obtain a copy of the Form.

(c) A public works contractor shall cooperate with the Department during an investigation or audit arising under the act.

§ 66.6. Specific requirements for public works subcontractors.

(a) Prior to beginning either onsite or offsite work on a public works project when the public works contractor's contract was executed after January 1, 2013, every subcontractor shall submit a completed Form to the contracting public body. During a public works contract, a new employee hired by a public works subcontractor, regardless of whether he will be working onsite or offsite of a public work or otherwise, shall be verified within 5 business days of his start date.

(b) Subcontracts between a subcontractor and its subcontractors are required to contain notification of the applicability of the act, information regarding the use of EVP and reference to the Department's web site at www.dgs.state.pa.us to obtain a copy of the Form.

(c) A subcontractor shall cooperate with the Department during an investigation or audit arising under the act.

§ 66.7. Public Works Employment Verification Form.

(a) The Form for use by public bodies, public works contractors and subcontractors is posted on the Department's web site at www.dgs.state.pa.us. The Form may not be changed or altered.

(b) The Form shall be signed by an authorized representative of the public works contractor or subcontractor. The representative shall have sufficient knowledge to make the representations and certifications in the Form.

(c) The Department may require the public works contractor or subcontractor to provide supporting documentation that the representative signing the Form had authority to legally bind the public works contractor or subcontractor.

(d) The submitted Forms shall be retained by the public body for the duration of the public work contract.

§ 66.8. Violations.

A public works contractor or subcontractor violates the act if it does either of the following:

(1) Fails to verify the employment eligibility of a new employee hired after January 1, 2013, through EVP in accordance with the act and this chapter.

(2) Makes a false statement or misrepresentation in connection with the completion or submission of the Form to a public body.

§ 66.9. Enforcement.

The Department will enforce the act through investigations, audits, sanctions and civil penalties in accordance with the following guidelines.

(1) *Investigations of complaints.* The Department will accept, review and investigate timely and credible complaints filed on the Complaint Form posted on the Department's web site.

(i) A complaint must contain sufficient information to enable the Department to investigate the allegation. The Department reserves the right to reject complaints that do not provide sufficient information. The Department will consider the timeliness of the complaint in assessing its credibility.

(ii) Public bodies, public works contractors and subcontractors shall cooperate with the Department during the investigation of a complaint.

(2) *Audits.* The Department will conduct complaint-based and random audits of public works contractors and subcontractors performing a public works contract for a public body in this Commonwealth. The Department reserves the right to determine the time, place and nature of audits.

(i) Public bodies, public works contractors and subcontractors shall cooperate with the Department during an audit.

(ii) Upon an audit, the Department may request, and the public works contractors and subcontractors shall provide, the following:

(A) Documentation of the date of hire of all employees.

(B) Documentation of compliance with the act through the utilization of EVP.

(C) Other information required by the Department to ensure compliance with the act and utilization of EVP.

(3) *Sanctions.*

(i) If the Department's investigation determines that a public works contractor or subcontractor failed to verify an employee through the use of EVP in accordance with the act and this chapter, the Department will issue sanctions as follows:

(A) *First violation.* The Department will issue a warning letter to the public works contractor or subcontractor detailing the violation. This letter will be posted on the Department's E-Verify web site at www.dgs.state.pa.us. A violation by a public works contractor or subcontractor that occurs 10 years or more after a prior violation will be deemed to be a first violation for purposes of sanctions.

(B) *Second violation.* The Department will initiate debarment proceedings against the public works contractor or subcontractor. Once final, these proceedings will prevent a public works contractor or subcontractor from submitting a bid or being awarded a contract

or subcontract on a public works contract in this Commonwealth for 30 calendar days from the date of debarment.

(C) *Third and subsequent violations.* The Department will initiate debarment proceedings against the public works contractor or subcontractor. Once final, these proceedings will prevent a public work contractor or a subcontractor from submitting a bid or being awarded a contract or subcontract on a public works contract in this Commonwealth for not less than 180 days and not more than 1 year from the date of debarment.

(ii) *Willful violation.* If the Department investigates and forms a reasonable belief that there has been a willful violation of the act, the Secretary will file a petition in Commonwealth Court seeking the Court to issue a rule to show cause why a public works contractor or subcontractor did not engage in a willful violation of the act. If the Court finds that there was a willful violation, the Department will petition to have the public works contractor or subcontractor debarred from public work contracts for 3 years from the date of the Court's determination.

(4) *Civil penalties.* If the Secretary or a designee makes a written determination that the violation is for failing to submit a complete Form or making a false statement or misrepresentation in the Form, the Department will assess a civil penalty of not less than \$250 and not more than \$1,000 for each violation. The amount of the penalty is at the Department's discretion. The Department will consider the severity of the violation, and prior violations in imposing civil penalties.

(5) *Notice and appeal.* Sanctions or civil penalties imposed by the Department, other than those violations found to be willful, are subject to the notice, appeal and other provisions of 2 Pa.C.S. (relating to administrative law and procedure).

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COMMONWEALTH OF PENNSYLVANIA

PUBLIC WORKS EMPLOYMENT VERIFICATION FORM

Date _____

Business or Organization Name (Employer) _____

Address _____

City _____ State _____ Zip Code _____

☐ Contractor ☐ Subcontractor (check one)

Contracting Public Body _____

Contract/Project No _____

Project Description _____

Project Location _____

As a contractor/subcontractor for the above referenced public works contract, I hereby affirm that as of the above 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 post January 1, 2013 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

EMPLOYEE BACKGROUND CHECK

- A. All contractors are advised that the County of Delaware requires employee background checks in accordance with Act 34 of 1985 Background Clearance Procedures 24 PS1-111, as amended (Act 114 of 2006, Act 70 of 2004, Act 48 of 2003, Act 153 of 2002, Act 30 of 1997, and Act 211 of 1990) 22 PA Code Chapter 8, as amended, Act 43 Public Works Employment Verification Act 43 PS-167.1-167.11, and Act 151 of 1997 (Child Abuse), as amended. Contractor shall include in his bid all costs associated with obtaining and maintaining currency of these clearance reports.
- B. Information of the PA State Criminal History can be obtained via the PA State Police website at <http://www.psp.state.pa.us/psp/cwp/view.asp? A=4&0=48275>.
- C. Information on the Federal (FBI) Criminal History Report (as of March 30, 2007) can be found at www.pa.cogentid.com.
- D. Information on the Public Works Employment Verification Act can be obtained from the Department of General Services, Public Works Employment Verification Compliance Office, Room 105 Tent Building, Public Works Department, 18th & Herr Streets, Harrisburg, PA 17125.
- E. Child Abuse Reports Information can be obtained through the PA Department of Public Welfare at <http://www.dpw.state.pa.us/general/formspub/003671038.htm>.

SECTION 011010 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project description.
2. Contract requirements.
3. Permits and licenses.
4. Contractor's use of the premises
5. Coordination requirements.
6. Coordination drawings.
7. Preconstruction meeting.

1.2 PROJECT DESCRIPTION

A. The project consists of:

1. Selective removals of general construction, HVAC, plumbing, and fire protection equipment and system components including sitework, ductwork, piping, Building Management System Controls, conduits, and wiring.
2. New fire pumps, piping, and related accessories.
3. New sprinkler piping, heat tracing, insulation, and accessories as indicated.
4. New fire pump room in the parking garage.
5. New exterior fire pump enclosure for the courthouse service.
6. New gas fired generators, gas piping, and accessories.
7. New HVAC systems, equipment, as indicated.
8. New plumbing systems, equipment as indicated.
9. New general construction and site development.
10. Testing, adjusting, and balancing.
11. Owner training.
12. Concrete work.
13. New wiring and electrical devices.
14. Construction phasing
15. Other work covered under this Contract as indicated or implied.

1.3 CONTRACT REQUIREMENTS

- A. The contract documents intend the Contractor completely construct the Work for the Owner.

1.4 THE WORK

A. Separate Contracts will be awarded for:

1. General Construction Work.
2. Mechanical Work.
3. Plumbing Work
4. Electrical Work.
5. Fire Suppression Work.

B. The work consists of the following construction:

1. All Contracts:

- a. Field verify accessibility for equipment installation.
- b. Any travel through building will require covering of corridor floors with skim boarding to prevent any damage occurring to existing construction. If damage occurs Contractor will be responsible for repair and/or replacement of such to maintain existing conditions.
- c. Replace and/or repair all site conditions damaged during access to and/or construction work during project completion.
- d. Contractors must submit at the completion of the project, in CD format, the following electronic documentation:
 - 1) In accordance with Section 011600 - "Product Requirements," submit operations and maintenance data.
 - 2) In accordance with Section 011800 - "Project Record Documents," submit final approved shop drawings, specification record data, and as-built drawings.
- e. Coordinate all system shut-down times with Owner prior to work commencing.
- f. New duct/piping/conduit penetrations constructed in accordance the Structural Documents and requirements on the respective Trade Documents.
- g. Verify and coordinate removal of all site materials including debris, demolition components, etc. with access to site location as described above.
- h. Comply with Requirements/Work in Division 00, and 01 Specification Sections.

2. General Construction Contract:

- a. Select Architectural removals as indicated.
- b. Select landscaping removals, and new landscaping.
- c. New parking garage fire pump room construction.
- d. New doors as indicated.
- e. New pump exterior enclosure concrete pad and both emergency generator concrete pad.
- f. Installation and finish of new louvers.
- g. Owner training.
- h. All drawings listed under the Architectural Drawings, Landscape Drawings, and Structural Drawings.
- i. All Work indicated in Division 02, 03, 04, 05, 07, 08, and 09 Specification Sections.

3. Mechanical Contract:

- a. Remove existing HVAC equipment, ductwork, piping, generator engine exhaust, and all related accessories.
- b. New HVAC equipment, ductwork, piping, valves, and all related accessories.
- c. New heat tracing on existing mechanical piping.
- d. Furnish new louvers.
- e. HVAC Controls.
- f. Testing, adjusting, and balancing.
- g. Owner training.
- h. All drawings listed under the Mechanical and/or HVAC Drawings
- i. All Work indicated in Division 23 Specification Sections.

4. Plumbing Contract:

- a. Remove existing Plumbing equipment, piping, and all related accessories.
- b. New bollards, constructed in accordance with the Structural Documents.
- c. New Plumbing equipment, piping, valves, and all related accessories.
- d. Incoming gas service upgrades
- e. New sump pumps.
- f. New heat tracing on existing plumbing piping.
- g. New bollards, constructed in accordance with the Structural Documents.
- h. Testing, adjusting, and balancing.
- i. Owner training.
- j. All drawings listed under the Plumbing Drawings.
- k. All Work indicated in Division 22 Specification Sections.

5. Electrical Contract:

- a. Remove existing wiring, devices, substation, generator, all related accessories, and wiring to existing equipment.
- b. New emergency generator(s).
- c. New transformer(s) and pads.
- d. New lighting and power
- e. New wiring, breakers, and circuits to new equipment.
- f. New fire alarm devices and wiring
- g. Owner training.
- h. All drawings listed under the Electrical Drawings.
- i. All Work indicated in Division 26, and 28 Specification Sections.

6. Fire Suppression Contract:

- a. Remove existing Fire Suppression equipment, piping, and all related accessories.
- b. New Fire Suppression equipment (fire pumps, jockey pumps, etc.), piping, valves, and all related accessories.
- c. New exterior, premanufactured fire pump enclosure.
- d. Incoming fire protection water service upgrades.
- e. New sprinkler systems.
- f. New heat tracing on fire protection piping.

- g. New bollards, constructed in accordance with the Structural Documents.
- h. Concrete pump pads.
- i. Testing, adjusting, and balancing.
- j. Owner training.
- k. All drawings listed under the Fire Suppression Drawings.
- l. All Work indicated in Division 21 Specification Sections.

C. Special Coordination:

1. The entire facility will be fully occupied and operational during construction.
 - a. Coordinate construction activities with the Owner.
 - b. Perform work during 2nd/3rd shift.
 - c. Provide Owner's access required for normal operations.
 - d. Provide required access for safety.
 - e. Provide facilities required by governing authorities to permit Owner's normal operation of occupied facilities.
2. Preconstruction phasing coordination:
 - a. Prior to start of physical construction:
 - 1) Coordinate phasing availability with the County.
 - 2) Hold a preconstruction meeting with building principals to review scheduling, milestones, coordinate phasing requirements, and obtain approvals.
 - a) Include County Representatives.
 - b) Copy the Professional on meeting minutes.
3. Refer to Section 011040 "Coordination" for general project coordination procedures and responsibilities, and designation of Project Administrator.
4. Prime Contractors must submit written schedule to Owner detailing demolition, timeline and new work sequences for the following:
 - a. Removals.
 - b. Installation of equipment and modifications to existing items.
 - c. All utility shutdowns.
 - d. Phased Construction timelines.
 - e. Contractors shall not proceed with work until Contractors receives written approval from the Owner.
5. Contractor's work must be phased and coordinated with Owner's personnel to minimize impact on facility operations.
6. Contractor's work must be phased and coordinated with other Prime Contractors to provide a fully operational system.

D. Construct work to allow Owner to occupy and operate all facilities during construction. The buildings will remain in operation at all times.

1. All disruption to existing utilities for tie-ins or demolition shall be coordinated with the Owner and a written request shall be submitted ten (10) days prior to disruption. Contractor shall not proceed with work until Contractor receives approval from the Owner.

1.5 REGULATORY REQUIREMENTS

- A. Submit copies of all permits, licenses, and similar permissions obtained, and receipts for fees paid, to the Professional.
- B. Comply with:
 1. Pennsylvania Department of Labor and Industry, UCC - 2018 International Building Code.
 2. Universal Accessibility Standards.
 3. NFPA 101 - 2018 Life Safety Code.
 4. NEL 2017 - National Electrical Code.
 5. Applicable regulations for **Delaware County, Pennsylvania**.

1.6 ACCESS TO THE SITE AND USE OF THE PREMISES

- A. The following existing facilities may not be used by construction personnel:
 1. Toilet rooms: Except Owner will designate specific toilet facilities for use by Contractors.
 2. Certain entrances those designated by the Owner for use by Contractors.
- B. The Owner will continue to occupy the existing building during the construction period.
 1. Conduct the work so as to cause the least interference with the Owner's operations.
 2. The Owner will endeavor to cooperate with the Contractor's operations when the Contractor has notified the Owner in advance of need for changes in Owner's operations in order to accommodate construction operations.
- C. Storage areas will be available on site as designated by Owner.
- D. Signs: Provide temporary construction signs.
 1. Do not allow posting of unauthorized signs.
 2. Do not install signs other than sign(s):
 - a. Specified.
 - b. Required by governing agencies.
 - c. Requested by the Owner.
- E. Access to the premises and into the working spaces is controlled and subject to the restrictions and instructions by the Owner.
- F. Entrance into, or other use of the existing building will not be permitted, except as required for the execution of the work.
- G. Routes for ingress and egress to areas where work is being performed shall be subject to the restrictions and instructions by the Owner.

- H. All workmen while engaged at the site on this Project shall wear identifying badges provided by the Owner. Return all badges to the Owner upon completion of the Work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PERMITS AND LICENSES

- A. Obtain permits and licenses from Authority Having Jurisdiction (AHJ) and other governing authorities require the Contractor obtain to:
 - 1. Proceed with the Work.
 - 2. Perform the Work.
- B. Paying for permits and licenses included in the bid needed to:
 - 1. Proceed with the Work.
 - 2. Perform the Work.

3.2 PRECONSTRUCTION MEETING

- A. A preconstruction meeting will be held at a time and place designated by the Owner for the purpose of identifying responsibilities of the Owner's personnel and explanation of administrative procedures.
- B. Also use this meeting for the following minimum agenda:
 - 1. Construction schedule
 - 2. Use of areas of the site.
 - 3. Delivery and storage.
 - 4. Safety.
 - 5. Security.
 - 6. Cleaning up.
 - 7. Subcontractor procedures relating to:
 - a. Submittals.
 - b. Change orders.
 - c. Applications for payment.
 - d. Record documents.
 - 8. Attendees shall include:
 - a. The Owner.
 - b. The Contractors and their superintendents.
 - c. Major subcontractors, suppliers, and fabricators.
 - d. Others interested in the work.

3.3 COORDINATION WITH OCCUPANTS

- A. Occupied areas include all areas in which the Owner's regular operations will be going on or to which the Owner requires access during the construction period.
- B. Limit access through occupied areas to those days and times which the Owner approves.
- C. Provide separate access from the exterior to the construction area, without disrupting operations in occupied areas.
- D. When the following must be interrupted, provide alternate facilities acceptable to the Owner:
 - 1. Emergency means of egress.
 - 2. Entrances which must remain open.
 - 3. Utilities which must remain in operation.

3.4 SECURITY PROCEDURES

- A. Limit access to the site to persons involved in the work.
- B. Provide secure storage for materials for which the Owner has made payment and which are stored on site.
- C. Secure completed work as required to prevent loss.
- D. The Owner's normal security procedures will remain in effect. Contractor personnel will be required to be checked in through security checkpoints.

3.5 COORDINATION

- A. Where necessary, in writing inform each party involved of special procedures required for coordination; describe required notices, reports, and attendance at meetings.
- B. Inform the Owner when coordination of his work is required.
- C. See other requirements in other portions of the contract documents.

END OF SECTION 011010

SECTION 011025 - PAYMENT, MODIFICATION AND COMPLETION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Schedule of values.
2. Payment procedures.
3. Modification procedures.
4. Completion procedures.

1.2 CONTRACT CONDITIONS

- A. See the conditions of the contract for additional requirements.
- B. The Owner will retain from each progress payment an amount equal to 10 percent of the value of the work covered by the progress payment and follow the provision identified in the General Conditions paragraph - Monthly Estimates and Payments.
1. At 50% completion the sum or sums withheld by the Owner for release of retainage from the Contractor shall not exceed 5% of the amount due the contractor, less:
 - a. Those amounts that are withheld to cover incomplete work.
 - b. Those amounts that are withheld to cover incorrect work.
 - c. Unsettled claims.
- C. No payment will be made for materials or equipment stored off site.
- D. Payments may be withheld if the Contractor fails to make dated submittals within the time periods specified.

1.3 DEFINITIONS

- A. Change Proposal Request: Any written request from the Consulting Engineer to the Contractor for a quotation, price, or breakdown on a change proposed but not ordered.
- B. Final Completion: The stage at which all incomplete and incorrect work has been completed/corrected in accordance with the contract documents.
- C. List of Incomplete Work: A comprehensive list of items to be completed/corrected, prepared by the Contractor for the purpose of obtaining certification of substantial completion. This list is also referred to as a "punchlist."
- D. Modifications: Written amendments to the contract signed by both the Consulting Engineer and the Contractor, these include:

1. Change orders.
 2. Construction change directives.
- E. Schedule of Values: A breakdown of the contract sum into component parts of sufficient detail to assist the Consulting Engineer in evaluating applications for progress payments during construction.
- F. Substantial Completion: The stage in the progress of the work when the work, or a designated portion thereof which the Owner agrees to accept separately, is sufficiently complete in accordance with the contract documents so that the Owner can occupy or utilize the work for its intended use.
- G. Time and Material Work: Work which will be paid for on the basis of the actual cost of the work, including materials, labor, equipment, and other costs documented by detailed records. This basis is also referred to using the terms "cost-plus," "cost of the work," "force amount," and similar terms.

1.4 SUBMITTALS

- A. Schedule of Values: First application for payment will not be reviewed without schedule of values. Submit on 8-1/2 inches by 11 inches form.
1. Submit 3 copies.
 2. Identify with:
 - a. Project name and location.
 - b. Project number.
 - c. Owner's name.
 - d. Contractor's name and address.
 - e. Date of submittal.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

- A. Prepare a schedule of values prior to the first application for payment.
- B. Schedule of Values: Provide a breakdown of the contract sum in sufficient detail to assist the Consulting Engineer's evaluation of applications for payment and progress.
1. Break costs down into line items which will be comparable with line items in applications for payment.
 - a. Correlate line items in the schedule of values with portions of the contract documents which identify units or subdivisions of work.
 - b. Provide cross-referencing needed for clarification.
 - c. Correlate with the project manual table of contents.

2. Break down major subcontracts into logical line items.
 3. For work where applications for payment are likely to include products which have been purchased or fabricated but not yet installed, provide separate line items for:
 - a. Product's cost.
 - b. Installation cost.
 - c. Cost of each other stage of completion.
 4. Include in each line items its proportional share of overhead and profit.
 5. Include the following information for each line item:
 - a. Generic name.
 - b. Related specification section.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Dollar value, rounded off to the nearest whole dollar. Adjust the total to equal the contract sum.
 - g. Percentage of the contract sum represented by this item, to the nearest one- hundredth percent. Adjust the total to 100 percent.
 6. Arrange schedule of values in tabular format.
 7. Use AIA Document G703.
- C. Submit the schedule of values within 15 business days after execution of the contract.
- D. The Consulting Engineer will notify the Contractor if the schedule is not satisfactory.
1. If the schedule is not satisfactory, revise and resubmit acceptable schedule.
- E. Update and resubmit the schedule of values when modifications result in a change to:
1. The contract sum.
 2. Individual line item(s).
 3. Make each modification a new line item.
 4. Show all information required for original submittal for each line item.
 5. Identify modifications which have affected its value.
- 3.2 APPLICATIONS FOR PAYMENT
- A. Application for Payment Forms: Use AIA G702, Application and Certificate for Payment, and AIA G703, Continuation Sheet.
- B. Preparation of Applications for Payment: Complete every entry on the form.
1. Prepare current application so it is consistent with:
 - a. Previous applications.
 - b. Previous certificates for payment.
 - c. Previous payments made.
 2. Base application on current:

- a. Schedule of values.
 - b. Contractor's construction schedule.
 3. Include amounts of modifications issued prior to the last day of the construction period covered by the application.
 4. Signed by person authorized to sign legal documents for the Contractor.
 5. Notarize each copy.
 6. Submit in 3 copies.
 7. Attach waivers of lien.
 8. If changes have occurred, attach revised schedule of values.
- C. Provide the following information with every application for payment which involves work completed on a time and material basis:
1. Reference approved change order authorizing work.
 2. Detailed records of work done, including:
 - a. Dates and times work was performed.
 - b. Name of person who performed the work.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products.
 3. Provide similar detailed records for subcontracts.
- D. Transmit application for payment with a transmittal form listing attachments.

3.3 WAIVERS OF LIEN

- A. With each application for payment, submit waiver of lien from the Contractor covering the work performed during the period covered by the previous application for payment.
- B. With final application for payment, submit complete waivers of lien from every entity who lawfully may be entitled to file a mechanic's or other lien arising out of the contract.
- C. Waiver of Lien Forms: Use forms acceptable to the Owner.

3.4 INITIAL PAYMENT PROCEDURES

- A. The first application for payment will not be reviewed until the following submittals have been received:
 1. Certificates of insurance.
 2. Performance and payment bonds.
 3. Schedule of values.
 4. List of subcontractors, principal suppliers, and fabricators.
 5. Contractor's construction schedule.
 6. Progress schedule.
 7. Submittal schedule.
 8. Quality control activities schedule.
 9. Schedule of products.
 10. Copies of building permits and other authorizations from authorities having jurisdiction.

11. First progress report.
12. Report of preconstruction meeting.
13. All submittals specified to occur prior to first application for payment or prior to first payment.

3.5 MODIFICATION PROCEDURES

- A. Designate a single individual authorized to receive change documents.
 1. This person will be responsible for informing others of changes to the work.
- B. Upon request, provide within 10 business days sufficient information for evaluation of proposed changes.
- C. Proposed change request: Provide the following information:
 1. The amount of change in the contract sum, if any.
 2. The amount of change in the contract time, if any, with explanation.
 3. Cost breakdown:
 - a. Separate to show:
 - 1) Quantities of materials.
 - 2) Labor.
 - 3) Quantities of equipment.
 - 4) Taxes.
 - 5) Insurance.
 - 6) Bonds.
 - 7) Warranties and guarantees.
 - 8) Related overhead and profit computed in the same manner specified for the schedule of values.
 - b. Use schedule of values line items.
 - c. Show additions and deletions.
 4. The period of time within which the proposed changes in contract sum or time will be valid.
 5. A statement describing the effect the change may have on the work of other prime Contractors.
- D. When changes are performed on a time and material basis, identify on the application for payment.
- E. Claims for additional cost:
 1. Claims for additional cost will not be considered unless submitted in writing within 10 working days of date that the earliest additional cost occurred.
 2. Provide the following information with every claim for additional costs:
 - a. Origin and date of claim.
 - b. Detailed records for time and material work.
 3. Provide the information required for proposed change request.

F. The Contractor may propose changes.

1. Do not use change order form.
2. Provide the information required for proposed change request.
3. Describe reasons for change.
4. Document proposed substitutions.

3.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Request for inspection and application for payment may coincide.

B. The Consulting Engineer will perform one inspection for substantial completion, upon request of the Contractor.

1. If the Consulting Engineer is unable to issue the certificate of substantial completion because the Consulting Engineer does not consider the work to be substantially complete, the Contractor shall pay all subsequent inspection costs, including compensation for the Consulting Engineer's and consultants' services and expenses.
2. When issuance of several certificates of substantial completion for portions of the work is authorized by the Consulting Engineer, the above provisions apply separately to each separate portion.

C. Do not submit request for inspection for substantial completion until the following activities have been completed:

1. Delivery of maintenance materials and tools.
2. Demonstration of all equipment and systems.
3. Removal of temporary facilities and services.
4. Changeover to permanent locking systems.
5. All activities specified to occur prior to substantial completion.

D. Do not submit request for inspection for substantial completion until the following submittals have been completed:

1. List of incomplete work.
2. Final testing, adjusting, and balancing reports.
3. Demonstration reports.
4. Instruction reports.
5. Warranties.
6. Operation and maintenance data.
7. Project record documents.
8. Final testing and balancing reports.
9. Final cleaning.
10. All submittals specified to occur prior to substantial completion.

E. Submit the following with application for payment at substantial completion:

1. Contractor's affidavit of release of liens.
2. Application for reduction of retainage.
3. Consent of surety to reduction in or partial release of retainage.
4. Final list of incomplete work.
5. Other data required by the contract documents.

3.7 FINAL COMPLETION PROCEDURES

- A. Request for final inspection and final application for payment may coincide.
- B. The Consulting Engineer will perform one inspection for final completion, upon request of the Contractor.
 - 1. Submit the following with request for inspection:
 - a. Previous inspection lists indicating completion of all items.
 - b. If any items cannot be completed, obtain prior approval of such delay.
 - 2. If the Consulting Engineer is unable to issue the certificate for final payment because the work is not complete, the Contractor shall pay all subsequent inspection costs, including compensation for the Consulting Engineer and consultants' services and expenses.
- C. Do not submit request for final inspection until the following activities have been completed:
 - 1. Completion of all work, except those items agreed upon by the Owner.
 - 2. Instruction of the Owner's personnel.
 - 3. Final cleaning.
 - 4. All activities specified to occur between substantial completion and final completion.
- D. Do not submit request for final inspection until the following submittals have been completed:
 - 1. Start-up reports.
 - 2. Maintenance agreements.
 - 3. All other outstanding specified submittals.
- E. Submit the following with the final application for payment:
 - 1. Certified copy of list of items to be completed or corrected, stating that each has been completed or otherwise resolved for acceptance.
 - 2. Updated final statement, accounting for final changes to the contract sum.
 - 3. Consent of surety to final payment.
 - 4. Release of liens.
 - 5. Refer to General Conditions - Acceptance and Final Payment.
 - 6. Final PA L&I Certified Payroll Forms.
 - 7. Other data required by the contract documents.

END OF SECTION 011025

SECTION 011040 - COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section. Contractor shall refer to Division 1, Section 011200, for specific reporting requirements.

1.2 SUMMARY

- A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
 - 1. Project Administrator.
 - 2. Project coordination procedures.
 - 3. Work coordination procedures.
 - 4. Conservation.
 - 5. Coordination Drawings.
 - 6. Administrative and supervisory personnel.
 - 7. Cleaning and protection.

1.3 PROJECT ADMINISTRATOR

- A. The Project Administrator shall provide the overall project coordination as indicated in paragraph 1.4 "Project Coordination". The Project Administrator work shall be performed by the **Prime Fire Suppression Contractor**.
- B. The Project Administrator shall be responsible for the Total Coordination of the Construction. The Project Administrator shall take all the work schedules submitted by the other Prime Contractors and submit a unified and coordinated schedule. The project schedule shall be updated to show completed work and reflect time line changes to the schedule.
- C. The Project Administrator shall attend all Owner-Engineer-Prime Contractor meetings. The Owner shall report project issues, phasing, and coordination items to the Project Administrator who shall coordinate and distribute information to Prime Contractors. The Prime Contractors shall submit requests and coordination items to the Project Administrator for processing and Owner-Engineer review.

1.4 PROJECT COORDINATION

- A. The Project Administrator shall have the responsibility for being the supervisor, manager, overseer, project coordinator, and expeditor of the total construction process and of its parts, in accordance with the contract documents. The Project Administrator shall incorporate "Work

Coordination” procedures herein in preparation of project administration responsibilities. A Project Administrator (manager/superintendent) shall be assigned to the project. The Administrator shall be available during construction hours for other Prime Contractors and Owner’s coordination of project.

- B. The Project Administrator shall be responsible to convene weekly meetings of all Prime Contractors’ Superintendents (Superintendents’ Meetings). The purpose of this meeting will be to review job progress, discuss construction issues, present scheduling issues and identify site conditions. Each Prime Contractor Site Superintendent shall attend these meetings to discuss and present their work schedule for the upcoming week and review job progress. Any and all Subcontractor’s work for any Prime Contractor shall be presented and reviewed. At the time of the Subcontractor beginning work, a representative of the Subcontractor shall attend the weekly meeting for the duration of his work. Meeting minutes shall be written and distributed to all parties, Owner, and Engineer. The results of these meetings shall be reviewed during the bi-weekly job meeting with the Owner and Engineer. The project administrator shall feedback and coordinate all issues with each Prime Contractor. Each Prime Contractor shall be responsible to discuss issues which his workman and Subcontractor to resolve each issue raised.
- C. The Project Administrator shall be responsible to convene weekly meetings with the Owner and Owner’s personnel affected by the project construction (Owner’s staff meeting). These meetings shall discuss phasing issues, project coordination, site access, space access, Prime Contractor activities, Subcontractor activities, site conditions and each parties’ responsibilities. All construction safety issues shall be discussed along with installation of temporary measures and facilities. Owner’s personnel shall discuss Owner’s requirements and conditions required for completing the construction. Utility shutdowns shall be discussed based on prior approval of the Owner. Site clean-up, workmen’s behavior, phasing, scheduling, and day-to-day issues shall be presented and discussed. Meeting minutes shall be written and distributed to all parties, Owner, and Engineer. Results of these meetings shall be presented at the bi-weekly job meeting.
- D. Shop Drawing submittals shall be processed in accordance to Division 01, Section “Submittals.” Approved Shop Drawings will be returned to the Prime Contractor sender. Copies of the Approved Shop Drawings shall be forwarded to the Project Administrator. The Project Administrator shall be responsible to distribute copies of Approved Shop Drawing(s) to Prime Contractor’s assigned Superintendent, whose work is dependent on the information presented in the shop drawing. Distribution of each shop drawing must be coordinated with Prime Contractor sender to determine appropriate routing. The Project
- E. Administrator shall log each shop drawing per Prime Contractor and its associated distribution list to other Prime Contractors. Log list shall be facilitated utilizing an electronic spreadsheet in table format and ascending in chronological order per each Prime Contractor. Log shall include equipment description, receiving and distribution dates, Prime Contractor’s name, and distribution Prime Contractor’s names. Update log list with each new submission. Computer generated printouts shall be submitted at each Owner meeting and electronic copy of final distribution log to be submitted at project completion.

1.5 WORK COORDINATION

- A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work shall be the responsibility of the Prime Contractors. Coordinate construction operations included under different Sections that depend

on each other for proper installation, connection, and operation. The Prime Contractors shall submit work schedules to the assigned Project Administrator in preparation of a unified and coordinated schedule.

1. Schedule construction operations in the 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 to assure maximum accessibility for required maintenance, service, and repair.
 3. Make provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.
- C. Prime Contractors shall be familiar with the requirements and procedures of the Project Administrator. It is each Prime Contractor's responsibility to coordinate work effort, process administrative data and furnish project requirements to the Project Administrator.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of schedules.
 2. Installation and removal of temporary facilities.
 3. Delivery and processing of submittals.
 4. Shop Drawing distribution coordination.
 5. Progress meetings.
 6. Superintendent meetings.
 7. Owner's staff meetings.
 8. Project closeout activities.
- E. Conservation: Coordinate construction operations to assure 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 in, the Work.

1.6 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
1. Show the relationship of components shown on separate Shop Drawings.
 2. Indicate required installation sequences.

3. Comply with requirements contained in Section "Submittals."
- B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.
- C. Approved Shop Drawing distribution log to be presented at each Owner meeting and at project completion, incorporated into O&M Manuals.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

- A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.
- B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- C. 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. Where applicable, such exposures include, but are not limited to, the following:
 1. Excessive static or dynamic loading.
 2. Excessive internal or external pressures.
 3. Excessively high or low temperatures.
 4. Thermal shock.
 5. Excessively high or low humidity.
 6. Air contamination or pollution.
 7. Water or ice.

8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION 011040

SECTION 011200 - PROGRESS DOCUMENTATION AND PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Progress documentation requirements:
 - a. Preliminary construction schedule.
 - b. Contractor's construction schedule.
 - c. Progress reports.
2. Progress meetings.

1.2 SUBMITTALS

A. Preliminary Construction Schedule:

1. Submit within 10 working days after execution of contract.

B. Contractor's Construction Schedule:

1. Submit within 20 working days after execution of contract.
2. Submit revised schedule with application for payment.

C. Daily Construction Reports:

1. Submit every week.

D. Progress Reports:

1. Submit with each application for payment.

E. Minutes of Progress Meetings:

1. Submit within 5 working days after meeting.

1.3 FORM OF SUBMITTALS

A. Schedules:

1. Provide legend of symbols and abbreviations, for each schedule.
2. Use the same terminology as that used in the contract documents.
3. When transparencies are submitted, use only reverse-reading Mylar (or similar film) wash-offs, which will not fade or lose contrast over time.

4. When opaque copies are submitted, submit 6 copies.

B. Charts:

1. Provide bar charts generated by network analysis data.
2. Provide a separate time bar for each significant construction activity.
3. Coordinate each element on the schedule with other construction activities.
4. Schedule each construction activity in proper sequence.
5. Show percentage of completion of each activity.
6. Include cost correlation bar at top of chart, showing:
 - a. Estimated and actual costs of work performed at the date of each application for payment.
7. Provide a continuous vertical line to identify the first working day of each week.
8. Prepare on reproducible transparency.
9. Use sheets of sufficient number and width to show data clearly for the entire construction period.
10. Display the sequence and relationship of activities graphically.
11. Indicate:
 - a. Early and late start dates.
 - b. Early and late finish dates.
 - c. Float, and duration.
12. Illustrate how:
 - a. Start of a given activity depends on completion of preceding activities.
 - b. Completion of a given activity may restrain start of subsequent activities.
13. Display full network on a single sheet of sufficient width to show data clearly for the entire construction period.
14. Separate sheets are permissible for activities which are clearly off the critical path.
15. Use "one working day" as the unit of time.
16. For each activity, collect, record, and update the following information:
 - a. Description of activity; separate into activities of not more than 15 working days' duration.
 - b. Immediately preceding and following activities.
 - c. Estimated duration in working days.
 - d. Earliest and latest start dates.
 - e. Earliest and latest finish dates.
 - f. Actual start and finish dates.
 - g. Float time.
 - h. Monetary value of activity, keyed to schedule of values.
 - i. Percentage of activity completed.
 - j. Size of work force required.
 - k. Entity responsible.

C. Reports:

1. Submit a minimum of 6 copies.

D. Prepare the following supporting reports:

1. Data summary:

- a. Sort data by activity.
- b. Sort data in event number order.

2. Critical path summary:

- a. Activity, preceding and succeeding activity.
- b. Early and late start dates.
- c. Early and late finish dates.
- d. Float (if greater than zero); sorted by activity occurrence.

3. Submit cost summary, include the following:

- a. Activity.
- b. Monetary value.
- c. Percentage complete.
- d. Cumulative value completed, sorted by schedule of values key:

- 1) Provide page and report totals.

1.4 COORDINATION

- A. In preparation of schedules, take into account the time allowed or required for the Consulting Engineer's administrative procedures.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRELIMINARY CONSTRUCTION SCHEDULE

- A. Provide preliminary construction schedule in the form of bar charts:

1. Show activities for the first 20 working days of construction in detail; show remainder in skeletal form.
2. Show date established for substantial completion.
3. Include dates and description of all submittals required during the first 3 months of construction.
 - a. Include those required by the construction schedule.
 - b. Submittal dates may be provided in a separate list rather than on the schedule.

B. The Consulting Engineer will notify the Contractor if schedule is not satisfactory.

1. If schedule is not satisfactory, revise to be satisfactory.
2. Resubmit within 5 working days.

3.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Prepare and submit a complete construction schedule.

1. Base construction schedule on preliminary construction schedule.
2. Adjust for changes since start of work.

B. Provide construction schedule in the form of bar chart with support reports.

1. Use the same breakdown of work used in the schedule of values.
2. Where related activities must be performed in sequence, show relationship graphically.
3. Incorporate the submittal schedule. (See Section 011300)
4. Incorporate the quality control activities schedule. (See Section 011400)
5. Show dates of:
 - a. Each activity having a bearing on the construction time.
 - b. Preconstruction meeting.
 - c. Specified preinstallation meetings.
 - d. Ordering dates for products requiring long lead time.
 - e. All submittals required.
 - f. Completion of general construction work.
 - g. Completion of mechanical work.
 - h. Completion of electrical work.
 - i. Instruction of the Owner's personnel in operation and maintenance of equipment and systems.
 - j. Substantial completion.
 - k. Final completion.
6. Include time for the Consulting Engineer's administrative procedures.
7. Indicate how schedule is affected by:
 - a. Work by the Owner.
 - b. Continued occupancy.
 - c. Interruption of services to occupied facilities.

8. Include cost summary.

C. The Consulting Engineer will notify the Contractor if schedule is not satisfactory.

1. If schedule is not satisfactory, revise to be satisfactory.
2. Resubmit within 5 working days.

D. Make and distribute copies of schedule to:

1. The Consulting Engineer.

2. Subcontractors.
 3. Other entities required to comply with schedule dates.
- E. Post a copy of the schedule in field office and meeting room.
- F. Updating schedule:
1. Update the schedule whenever:
 - a. Revisions are recognized or made.
 - b. When new information is received.
 - c. But not less often than at the same intervals at which applications for payment are made.
 2. Indicate changes made since last issue.
 3. Show actual dates for activities completed.
 4. Submit updated schedule with application for payment.
 5. Issue updated schedule with report of meeting at which revisions are made.
 6. Issue updated schedule in same manner as original schedule.
 7. Include the same supporting reports as for original schedule.
 8. Narrative summary of all changes in the revised schedule.

3.3 PROGRESS REPORTS

- A. Daily Construction Logs: Every day, record the following information concerning events at the site:
1. General weather conditions; high and low temperatures.
 2. Approximate number of persons at the site.
 3. Visitors to the site.
 4. All information required of each prime Contractor.
 5. Change orders received; change orders implemented.
 6. Delays and stoppages.
 7. Emergencies and accidents.
 8. Equipment and system tests and start-ups.
 9. Meetings held and significant decisions made there.
 10. Names of subcontractors at site.
 11. Special reports made.
 12. Orders and requests of authorities having jurisdiction.
 13. Unusual events.
 14. Utility service disconnections and connections.
- B. Preparing Progress Reports:
1. Prepare as a narrative report.
 2. Describe the general state of completion of the work.
 3. Describe the following in detail:
 - a. Actual and anticipated delays.

- 1) Their impact on the schedule.
 - 2) Corrective actions taken or proposed.
-
- b. Actual and potential problems.
 - c. Status of change order work.
 - d. Effect of delays.
 - e. Problems.
 - f. Changes on the schedules of other prime Contractors.
 - g. Outstanding change proposal requests.
 - h. Status of corrective work ordered by the Consulting Engineer.
 - i. Status of quality control activities specified in Section 011400.

3.4 PROGRESS MEETINGS

- A. Schedule and conduct periodic progress meetings during construction period.
 1. Have meetings every other week.
 - a. More often if required by the progress of the Work.
 2. Notify the Consulting Engineer at least one week in advance of date of meeting so the Consulting Engineer may attend.
- B. The following are required to attend:
 1. Project superintendent.
 2. Major subcontractors and suppliers.
- C. Prepare and distribute agenda prior to meetings; cover the following topics when applicable:
 1. Review minutes of previous meeting.
 2. Status of submittals and impending submittals.
 3. Off-site fabrication and delivery schedules.
 4. Actual progress of activities in relation to the schedule.
 5. Actual and anticipated delays, their impact on the schedule, and corrective actions taken or proposed.
 6. Actual and potential problems.
 7. Status of change order work.
 8. Effect of proposed changes on schedule and coordination.
 9. Status of corrective work ordered by the Consulting Engineer.
 10. Progress expected to be made during the next period.
- D. Record minutes and distribute copies within 5 working days to the Consulting Engineer, to all participants, and to all entities affected by decisions made.

END OF SECTION 011200

SECTION 011300 - SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparing and processing submittals for review and action.
2. Preparing and processing informational submittals.

1.2 RELATED SECTIONS: The following are specified elsewhere in Division 01:

A. Payment, modification, and completion submittals.

1. Applications for payment.
2. Schedule of values.
3. Change proposals.

B. Progress of work submittals:

1. Contractor's construction schedules.
2. Progress reports.

C. Quality control submittals:

1. Inspection reports.
2. Test reports.

D. Product submittals:

1. Operating and maintenance data.
2. Warranties.
3. Maintenance materials and tools.

E. Contract closeout submittals:

1. Equipment and systems demonstration reports.
2. Request for determination of substantial completion.
3. Project record documents.
4. Bonds.

1.3 DEFINITIONS

A. Shop Drawings:

1. See General Conditions.
2. Shop drawings also include product data specifically prepared for this project.

B. Product Data:

1. See General Conditions.
2. Product data submittals also include:
 - a. Performance curves, when issued by the manufacturer for products of that type.
 - b. Standard color charts.
 - c. Standard wiring diagrams.

C. Informational Submittals: Submittals which the contract documents indicate are to be submitted for information only.

1.4 SUBMITTING SUBMITTALS

A. Submit submittals for work by Each Prime Contractor and Subcontractors to Consulting Engineer.

B. Submit the following for the Consulting Engineer's review and action:

1. Shop drawings.
2. Product data.

C. Submit the following as informational submittals:

1. Structural design information required by the contract documents.
2. Certificates.
3. Coordination drawings.
4. Reports.
5. Qualification statements for manufacturers/installers.
6. Schedule of values.
7. Submittals for which procedures are not defined elsewhere.

D. Specific submittals are described in individual sections.

E. Do not commence work which requires review of submittal until receipt of returned submittal with appropriate final action.

F. Do not allow submittal, without an appropriate final action marking, to be used for the project.

G. Do not submit substitute submittals, requiring other's review, until such submittals have been approved by such others.

1. Show approvals on submittal.

H. Do not include requests for substitution (either direct or indirect) on submittals. (For such requests, comply with procedures for substitutions specified in Section 011025)

1.5 FORM OF SUBMITTALS

A. Sheets Larger Than 8-1/2 by 11 Inches:

1. Sheet size: 24 inches by 36 inches or 30 inches by 42 inches only. Exceptions:
 - a. Full size pattern or template drawings.
 - b. Computer generated charts and graphs.
2. Submittals for review, submit:
 - a. Electronic pdf via email.
3. Information submittals: Electronic pdf via email.

1.6 COORDINATION OF SUBMITTALS

- A. Coordinate preparation and processing of submittals with performance of the work.
- B. Coordinate each separate submittal with:
 1. Other submittals.
 2. Related activities that require sequential performance.
- C. Submit different units of interrelated work at the same time.
 1. Submit together so that the Consulting Engineer may refer to related submittals during review.
 2. The Consulting Engineer will withhold action on any such submittals until the related submittals are received.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TIMING OF SUBMITTALS

- A. Transmit each submittal at or before the time indicated on the approved schedule of submittals.
- B. Prepare a schedule showing all submittals and the latest submittal dates required for coordination of the work.
 1. Organize the schedule by the applicable specification section number.
 2. Submit the schedule within 20 working days after commencement of the work.
 3. Submit for approval.
 4. The Consulting Engineer will notify the Contractor if schedule is not satisfactory.
 - a. If schedule is not satisfactory, revise to be satisfactory.
 - b. Resubmit within 5 working days.
- C. Prepare and transmit each submittal requiring approval.

1. Submit sufficiently in advance of scheduled the work to allow for adequate review and processing.
 2. Allow time for resubmittal.
- D. Where possible, prepare and transmit each informational submittal prior to start of the work involved.
1. Where the submittal cannot be prepared until after completion of the work, submit promptly.
- E. If processing time for a particular submittal will be critical to progress of the work, so advise the Consulting Engineer on the submittal.
- F. Allow a minimum of 10 business days (from the reviewer's receipt of submittal) for the Consulting Engineer's initial processing of each submittal.
1. Allow more time when submittals must be coordinated with other submittals.
- G. Resubmit corrected submittals for items where previous submittal was not approved.
1. Resubmit as specified in this Section.
- H. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the work.

3.2 SUBMITTAL PROCEDURES - GENERAL

- A. Contractor Review:
1. Prior to submittal to Consulting Engineer, review each submittal to verify compliance with contract documents.
 2. Sign each copy of each submittal certifying compliance with the contract documents.
- B. Notify the Consulting Engineer, in writing and at time of submittal, of deviations from requirements of the contract documents.
- C. Preparation of Submittals:
1. Mark submittal with a permanent label for identification. Provide the following information on each label:
 - a. Project name.
 - b. Date of submittal.
 - c. Name and address of the Contractor.
 - d. Name and address of subcontractor.
 - e. Name and address of supplier.
 - f. Name of manufacturer.
 - g. Number and title of applicable specification section requiring the submittal.
 - h. Drawing number and detail references, when applicable.
 - i. Other necessary identifying information.

2. Package each submittal appropriately.

D. Transmitting Submittals:

1. Submittals will be accepted from the Prime Contractors only.
 - a. Submittals received from other entities will not be reviewed.
2. Transmit each submittal with a transmittal form.
 - a. Submittals received without a transmittal form will be returned without action.
 - b. Use AIA Document G810, Transmittal Form.
3. Fill out a separate transmittal form for each submittal.
4. Include other relevant information.
5. Include requests for additional information.

3.3 SHOP DRAWINGS

A. Content: Include the following information:

1. Dimensions at accurate scale.
2. Specific notation of field measurements at accurate scale.
3. Identification of specific products and materials.
4. Details, identified by contract document sheet and detail numbers.
5. Compliance with specified standards.
6. Title block with name of firm that prepared the drawing.
7. Date the drawing was prepared.

B. Coordination requirements:

1. Show relationship to:
 - a. Adjacent work.
 - b. Critical work.

C. Preparation:

1. Do not reproduce contract documents as shop drawings.
2. Do not copy standard printed documents as shop drawings.

3.4 PRODUCT DATA

A. Submit all product data submittals for each system or unit of work as one submittal.

B. Where product data submittals must be prepared specifically for this project because standard printed information is not suitable for use:

1. Submit as shop drawings.
2. Do not submit as product data submittals.

C. Content:

1. Submit manufacturer's standard printed data sheets.
2. Identify the particular product being submitted.
3. Submit only pertinent pages.
4. Show compliance with properties specified.
5. Mark to show which options/accessories are applicable to the project.
 - a. Use black, felt tip pen or similar marking device to cross-out options/accessories which are not applicable.
 - b. Do not highlight applicable options/accessories.
6. Include recommendations for application and use.
7. Show compliance with specified standards.
8. Show compliance with specified testing agency listings.
 - a. Show the limitations of their labels or seals, if any.
 - b. Identify dimensions which have been verified by field measurement.
9. Include special coordination requirements for their product.

3.5 REVIEW OF SUBMITTALS

- A. Submittals for approval will be reviewed, marked with appropriate action, and returned.
- B. Informational submittals: Submittals will be retained for use by Consulting Engineer.

3.6 RETURN, RESUBMITTAL, AND DISTRIBUTION

- A. Submittals will be returned to the Contractor via email.
- B. Perform resubmittals in the same manner as original submittals.
 1. Exception: Transmittal number for resubmittal shall be the same number as the original plus a letter suffix; example: 051500-1 would become 051500-1A.
 2. Indicate all changes.
 - a. Highlight changes other than those requested by the Consulting Engineer.
- C. Distribution:
 1. Distribute returned submittals to subcontractors and suppliers involved in work covered by the submittal.
 2. Make extra copies for operation and maintenance data submittals.
 3. Make one copy for project record documents.
 4. Show distribution on transmittal form with copy to the Consulting Engineer.

END OF SECTION 011300

SECTION 011400 - QUALITY CONTROL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General quality control activities.
 2. Procedures for the following:
 - a. Preparation and maintenance of schedule of quality control activities.
 - b. Design performed by Contractor, if applicable.
 - c. Testing and evaluation of test results.
 - d. Inspections.
 - e. Manufacturers' field services.
 3. Procedures for quality control activities performed by:
 - a. Public authorities having jurisdiction.
 - b. Contractor.
 - c. Manufacturers' representatives
 4. Procedures for submittal of quality control documentation.
- B. Quality control activities are specified in sections which cover the related work.
- C. See General Conditions for additional requirements for testing, inspections, and approvals.

1.2 RELATED SECTIONS

- A. Progress reports and Contractor's construction schedules: Section 011200.
- B. Submittal procedures: Section 011300.

1.3 DEFINITIONS

- A. Certificate:
1. A written statement that a portion of the work as accomplished conform to the requirements of the contract documents.
- B. A written statement that a particular product conforms to the requirements of the contract documents.

C. Installer

1. An entity who performs a construction activity, such as installation, erection, application, and similar operations, whether an employee, subcontractor, or sub- subcontractor of the Contractor.

1.4 REFERENCE STANDARDS

A. Reference Standards - General:

1. Comply with edition of standard indicated.
2. Compliance with revised standards (those which are reissued after the edition date indicated in the contract documents) will not be required.
3. Obtain and follow instructions, from the authorities having jurisdiction, as to which edition of applicable codes, laws, and regulations governs.
 - a. Comply with edition of applicable codes, laws, and regulations indicated by authorities having jurisdiction.

B. Reference standards have the same effect as if they were bound into or copied into the contract documents, however:

1. No provisions of reference standards shall alter the contractual relationship of the parties to the contract.

C. Keep at the site at least one copy of each reference standard specified which covers:

1. Field mixing.
2. Installation quality.
3. Field quality control methods.

1.5 SUBMITTALS

A. Schedule of Quality Control Activities:

1. Submit as part of the Contractor's construction schedule specified in Section 011200.
2. Distribute to:
 - a. The Consulting Engineer.
 - b. Entities performing work for which quality control activities are specified.

B. Reports:

1. Provide certified copies of reports.
2. Unless otherwise indicated, submit for information only.
3. Submit reports within 2 weeks after execution of quality control activity, but:
 - a. Not later than the date of application for payment for the work to which the quality control activity relates.

4. The entity performing the quality control activity shall prepare reports on their activity.
5. When so directed by Consulting Engineer, submit additional copies directly to public authorities having jurisdiction.
6. Include the following information in all types of reports:
 - a. Date of report.
 - b. Project name.
 - c. Description of the quality control activity.
 - d. Name, address, and telephone number of entity performing activity.
 - e. Date quality control activity was performed.
 - f. Specification section(s) involved.
 - g. Basis for evaluation (test method, etc.).
 - h. Results or conclusions, including evaluations and interpretations.
 - i. Title, name, and signature of person performing activity.
 - j. Title, name, and signature of person authorized to make certification.
7. Include the following information in all test reports:
 - a. Locations from which samples were taken, if any.
 - b. Ambient conditions at time of activity.
 - c. Recommendations on retesting, if any.

C. Certificates: Submit for information only, unless otherwise indicated.

1. Certificates shall be signed by the product manufacturer.
2. Include the following information:
 - a. Date of certificate.
 - b. Project name.
 - c. Description of the product or system certified.
 - d. Specification section(s) involved.
 - e. When actual materials to be used are to be certified, include lot identification markings, destination or shipment, and quantity in shipment.
 - f. Title, name, and signature of person authorized to make certification.

D. Qualification Statements:

1. Submit for information only.

E. Manufacturers' Instructions:

1. Submit for information only.
2. Identify conflicts with contract documents.

1.6 QUALITY ASSURANCE

A. Qualifications of Structural Design Personnel:

1. As indicated in individual sections.

2. Provide services of a professional engineer licensed in the Commonwealth of Pennsylvania.

B. Professional Engineer Qualifications:

1. A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

C. Qualifications of Contractor's Design Personnel:

1. The term "experienced," unless otherwise indicated means, having at least 3 years of successful design experience on products similar to those to be used on this project.
2. Where no specific qualifications are specified, use only experienced designers.

D. Qualifications of Manufacturers:

1. As indicated in individual sections.
2. The term "experienced," unless otherwise indicated means, having at least 3 years of successful design experience on products similar to those to be used on this project.
3. Where no specific qualifications are specified, use only experienced manufacturers.

E. Qualifications of Installers:

1. As indicated in individual sections.
2. The term "experienced," unless otherwise indicated means, having at least 3 years of successful design experience on products similar to those to be used on this project.
3. Where no specific qualifications are specified, use only experienced installers.

F. Qualifications of Manufacturers' Field Personnel:

1. Manufacturers' field personnel shall be:
 - a. Full-time employees, employed directly by the manufacturer.
 - b. Normally performing the activities specified.
2. Manufacturers' field personnel shall have at least 3 years experience performing the activities specified.

G. Qualifications of Testing and Inspection Personnel:

1. As indicated in individual sections.
2. The term "experienced," unless otherwise indicated means, having at least 3 years of successful design experience on products similar to those to be used on this project.
3. Where no specific qualifications are specified, use only experienced personnel.

H. Testing Equipment:

1. Calibrate at reasonable intervals with devices of an accuracy traceable to the National Bureau of Standards (NBS).

1.7 COORDINATION WITH OTHER ENTITIES

- A. Cooperate with other entities performing quality control activities, provide:
 - 1. Provide the following information for each activity:
 - a. Specification section or drawing number.
 - b. Description of the activity.
 - c. Identification of test or inspection methods.
 - d. Enumeration of results required.
 - e. Number of tests required.
 - f. Number and type of samples to be taken, if any.
 - g. Starting time of activity.
 - h. Date work will be ready for testing agency's access.
 - i. Elapsed time required for activity.
 - j. Entity responsible.
 - k. Special requirements for activity.
- B. Coordinate quality control activities to avoid delay and to avoid the necessity of removing and replacing construction to accommodate testing and inspections.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Where quality level is not indicated, provide work of quality customary in similar types of work.
- B. Where codes/laws/regulations require work of higher quality/performance, provide work complying with those codes, laws, and regulations.
 - 1. Where two or more quality provisions of the contract documents conflict, comply with the most stringent requirement.
 - 2. Where requirements are different and it is disputable which requirement is most stringent, obtain clarification from the Consulting Engineer before proceeding.
 - 3. Where actual quality may exceed the specified quality; verify that such difference is acceptable to the Consulting Engineer (other criteria may make excessive quality undesirable).
- C. Where the Contractor is required to complete the design, use:
 - 1. Experienced designers.
 - 2. Accepted methods and procedures which result in work of the specified quality.
- D. Control the following in such a manner as to produce work of the specified quality:
 - 1. Products.
 - 2. Suppliers.

3. Manufacturers.
4. Site conditions.
5. Installers.
6. Workmanship.

E. Comply with manufacturers' instructions and recommendations.

1. Keep a record of manufacturers' supplemental instructions and recommendations which supplement or conflict with the manufacturers' standard printed instructions.
 - a. Notify Consulting Engineer of conflicts.
 - b. Follow Consulting Engineer's instructions.
2. When manufacturers' instructions/recommendations conflict with the contract documents, obtain clarification from the Consulting Engineer before proceeding.

F. Use installers who are experienced in producing work of the specified quality.

G. Perform all quality control activities specified unless specifically indicated to be performed by other entities.

3.2 TESTING

- A. Perform tests specified.
- B. When results of tests are unsatisfactory, make whatever changes or repairs are necessary and re-test.
- C. Submit written report of each original test and of each retest.

3.3 INSPECTING

- A. Perform inspections specified.
- B. When inspections reveal unsatisfactory work, make whatever changes or repairs are necessary and reinspect.
- C. Submit written report of each original inspection and each reinspection.

3.4 MANUFACTURERS' FIELD SERVICES

- A. Manufacturers' field services required are specified in sections which cover the related work.
- B. Give the Consulting Engineer timely notice of when manufacturers' field services personnel visits, recording the following:
 1. Site conditions.
 2. Installer procedures.
 3. Related activities which are not as recommended by the manufacturer.

4. Instructions given which differ from the manufacturers' standard printed instructions.
5. Recommendations given which differ from the manufacturers' standard printed instructions.

3.5 REPAIR AND PROTECTION

- A. Upon completion of quality control activities:
 1. Repair damaged construction.
 2. Restore finished to specified condition.
 3. Use patching methods which result in acceptable visual appearance.
- B. Protect construction exposed by or for quality control activities.

END OF SECTION 011400

SECTION 011500 - TEMPORARY FACILITIES AND SERVICES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Permanent Facilities: Construction, fixtures, fittings, and built items which are incorporated into the finished work.
- B. Temporary Facilities: Construction, fixtures, fittings and built items required to accomplish the work but which are not incorporated into the finished work.
- C. Temporary Utilities:
 - 1. A type of temporary facilities.
- D. Temporary Services: Activities during construction which do not directly accomplish the work.
- E. Construction Equipment:
 - 1. A type of temporary facility.
 - 2. Consists of fixed equipment used to accomplish the work.
 - 3. Determined by the method the Contractor chooses to use to accomplish the work.
 - 4. Construction aids and miscellaneous services and facilities.

1.2 QUALITY ASSURANCE

- A. Comply with requirements of authorities having jurisdiction, as to:
 - 1. Type of temporary facilities.
 - 2. Quantity of temporary facilities.
 - 3. Location of temporary facilities.
 - 4. Use of temporary facilities.
- B. Comply with requirements of authorities having jurisdiction, as to type and frequency of temporary services.
- C. Comply with requirements of public utilities affected.
- D. Comply with Owner's insurance requirements.

1.3 PROJECT CONDITIONS

- A. Use of permanent facilities prior to substantial completion is subject to Owner's conditions.
 - 1. The installer of each permanent facility used for construction purposes shall assume responsibility for its:

- a. Operation prior to substantial completion.
- b. Maintenance prior to substantial completion.
- c. Protection prior to substantial completion.

2. Specified warranties shall not be reduced or voided by temporary use.

B. Use of existing facilities is subject to the Owner's approval and conditions.

1.4 SEQUENCING AND SCHEDULING

A. Maintain required facilities until not needed.

1. Remove temporary facilities prior to substantial completion.
2. Exception: Where use of permanent facilities is allowed, do not remove such permanent facilities.

B. When applicable, change over to use of permanent facilities as soon as possible.

1. Exception: When use of such permanent facilities is specifically not allowed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials which:

1. Are suitable for the use.
2. Are durable enough to withstand the use and abuse.
3. Comply with the requirements of:
 - a. Governing authorities.
 - b. Owner's insurance requirements.

2.2 EXISTING PERMANENT UTILITIES

A. Water and electricity will be provided at no cost to the Contractors.

2.3 PROTECTIVE FACILITIES

A. Fire Protection Facilities:

1. Provide at least the temporary facilities required by:
 - a. The authorities having jurisdiction.
 - b. Factory Mutual.
 - c. Owner's insurance requirements.

B. Toilet Facilities:

1. Existing toilet facilities may be used.
 - a. Use only toilet facilities designated by the Owner.
2. Clean and maintain toilet facilities.

2.4 TEMPORARY DUMPSTER

- A. Prime Contractors shall provide trash/debris containers as required for construction operations.
- B. All dumpster locations are to be approved by Owner before bringing on site.

PART 3 - EXECUTION

3.1 GENERAL

- A. Cooperate with other contractors in location of temporary facilities.

3.2 TEMPORARY SERVICES

A. Waste Disposal Service:

1. Provide contracted removal service at regular intervals.
2. Remove waste at least once a week.
 - a. When temperature rises above 80 degrees F, remove at least twice a week.

B. Security Services:

1. The Owner will maintain his normal security during the construction period.
2. Abide by Owner's security instructions.

3.3 TERMINATION AND REMOVAL

A. Remove each temporary facility when:

1. The need has ended.
2. When replaced by authorized use of permanent facility.
3. Not later than substantial completion.
4. Exception: When requested by the Owner.

- B. Complete permanent work which was delayed because of interference with temporary facilities.

C. Permanent Facilities Used during Construction:

1. Clean facilities; renovate if required.
2. Equipment:
 - a. Replace parts that are worn.
 - b. Replace parts that have been subject to unusual operating conditions.

END OF SECTION 011500

SECTION 011510 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Bidder shall insert on the Proposal Form, all Unit Prices applicable to the work under his bid. Unit Prices will be used as the basis for computing "additions to" or "deductions from" the Contract Price for extra work and for work countermanded, reduced, or omitted.
- B. Except as otherwise provided in the General Conditions, the Unit Prices when accepted, adjusted, or established by the Contract shall remain binding and irrevocable for the entire period of the Contract, regardless of the quantities of work ordered or required under such Unit Prices.
- C. The acceptance of the Unit Price is on condition that the general character of the material and workmanship required for any work related thereto shall be equivalent to corresponding work as shown and specified, and that all costs, overhead and profit, as well as all incidental work required in connection therewith, has been included in the Unit Price.

1.2 RULES OF MEASUREMENT: EARTHWORK

- A. Except as provision is made hereinafter for arbitrary measurement, the quantity of excavation shall be its in-place volume before removal.
- B. The reference point for computing changes in depth shall be the plan grade at which the change starts.
- C. No allowance will be made for excavating additional material of any nature taken out for the convenience of the Contractor beyond the quantity computed under these Rules of Measurement.
- D. General excavation for buildings shall arbitrarily be assumed to extend to vertical planes 2 feet outside of the outside wall lines and to the elevation of the plan subgrade.
- E. Excavations shall be in accordance with OSHA requirements and that excavations should be shored and braced, as needed, to avoid encroaching into existing site improvements that are noted to remain undisturbed.
- F. Excavation for a footing (the pad) under a wall shall be measured as the neat plan width and depth of the footing
- G. Rock excavation shall arbitrarily be assumed to extend to vertical planes one foot beyond wall lines, pipe, etc., and to 6 inches below the established elevations.
- H. Excavation for footings for columns or piers shall be computed as vertical shafts, each with a horizontal cross section identical in shape and size with the bottom of the footing.

- I. Excavation for sump and other pits shall be computed as vertical shafts, each with a horizontal cross section identical in shape and size with the plan of the bottom of the construction installed (out to out of pit walls).
- J. The volume of backfill shall be the volume of excavation computed under these Rules of Measurement, less the volume of actual displacement by walls, beams, columns, piers, footings or other construction installed.
- K. Concrete quantities shall be computed from plan size, or if there are no drawings, from actual measurement of the work ordered and placed.

1.3 UNIT PRICES - GENERAL CONSTRUCTION: Materials in Place.

Excavation (unsuitable soil)	\$_____ per cu. yd.
Compacted fill	\$_____ per cu. yd.
Bituminous Paving (including subbase)	\$_____ per sq. yd.
Concrete Curb	\$_____ per lin. ft.
Concrete Walk (including subbase)	\$_____ per sq. ft.
Structural/Misc Steel: Fabricated, erected, coated, and painted steel (W.F. Sections, angles, frames or miscellaneous steel) Include shop drawings, fabrication & erection.	\$_____ per ton.

1.4 UNIT PRICES – MECHANICAL CONSTRUCTION: Materials in Place.

Galvanized steel ductwork, no liner < 2" static pressure	\$_____ per lb.
Rigid duct insulation (1-inch thick)	\$_____ per sq. ft.
4" heating hot water piping insulation	\$_____ per lin. ft.
6" heating hot water piping insulation	\$_____ per lin. ft.
4" chilled water piping insulation	\$_____ per lin. ft.
6" chilled water piping insulation	\$_____ per lin. ft.
277 volt heat tracing for 6" insulated piping with 2" mineral fiber insulation	\$_____ per lin. ft.
4" condenser water piping insulation	\$_____ per ft.
6" condenser water piping insulation	\$_____ per ft.
Wall mounted temperature sensor, including wiring	\$_____ per unit
Direct digital control system space temperature sensor including wiring (with no display and adjustment)	\$_____ per unit
Direct digital control system damper actuator	\$_____ per unit

Direct digital control system communication bus wiring with conduit	\$_____ per lin. ft.
Direct digital control system programming	\$_____ per unit

1.5 UNIT PRICES – PLUMBING CONSTRUCTION: Materials in Place.

Excavation (unsuitable soil)	\$_____ per cu. yd.
Compacted fill	\$_____ per cu. yd.
Bituminous Paving (including subbase)	\$_____ per sq. yd.
Concrete Curb	\$_____ per lin. ft.
Concrete Walk (including subbase)	\$_____ per sq. ft.
2" sanitary and vent pipe above grade	\$_____ per lin. ft.
2" sanitary and vent pipe below grade	\$_____ per lin. ft.
3" sanitary and vent pipe below grade	\$_____ per lin. ft.
4" sanitary and vent pipe below grade	\$_____ per lin. ft.
2-1/2" black iron above grade natural gas piping with hangers (painted yellow)	\$_____ per 8 ft. section
3" black iron above grade natural gas piping with hangers (painted yellow)	\$_____ per 8 ft. section
4" black iron above grade natural gas piping with hangers (painted yellow)	\$_____ per 8 ft. section
3" mechanical trap seal in floor drain	\$_____ per unit
4" mechanical trap seal in floor drain	\$_____ per unit

1.6 UNIT PRICES – FIRE SUPPRESSION CONSTRUCTION: Materials in Place.

Sprinkler Head including branch piping (approximately 10 ft.) and connection branch main	\$_____ per unit
277 Volt Heating Tracing on 6" piping with 2" insulation	\$_____ per 10 lin. ft.
Fire Protection system – Tamper Switch	\$_____ per unit
Fire Protection system – Flow Switch	\$_____ per unit
1/2" Type "L" copper tubing	\$_____ per lin. ft.
3/4" Type "L" copper tubing	\$_____ per lin. ft.

SPRINKLER PIPING & FIRE PUMP MODIFICATIONS
AT GOVERNMENT CENTER COMPLEX

GILLAN & HARTMANN, INC.
2020-183

1" Type "L" copper tubing	\$_____ per lin. ft.
1-1/2" Type "L" copper tubing	\$_____ per lin. ft.
2" Type "L" copper tubing	\$_____ per lin. ft.
2-1/2" Type "L" copper tubing	\$_____ per lin. ft.
1" black steel schedule 40 pipe	\$_____ per lin. ft.
1-1/2" black steel schedule 40 pipe	\$_____ per lin. ft.
2" black steel schedule 40 pipe	\$_____ per lin. ft.
2-1/2" black steel schedule 40 pipe	\$_____ per lin. ft.
3" black steel schedule 40 pipe	\$_____ per lin. ft.
4" black steel schedule 40 pipe	\$_____ per lin. ft.
5" black steel schedule 40 pipe	\$_____ per lin. ft.
6" black steel schedule 40 pipe	\$_____ per lin. ft.
8" black steel schedule 40 pipe	\$_____ per lin. ft.
8" C.I.C.L Underground piping	\$_____ per 5 ft. section
10" C.I.C.L Underground piping	\$_____ per 5 ft. section
Ball Valve, under 1"	\$_____ per unit
Ball Valve, 1"	\$_____ per unit
Ball Valve, 1-1/2"	\$_____ per unit
Ball Valve, 2"	\$_____ per unit
Ball Valve, 2-1/2"	\$_____ per unit
Ball Valve, 3"	\$_____ per unit
Gate Valve, 2-1/2"	\$_____ per unit
Gate Valve, 3"	\$_____ per unit
Gate Valve, 4"	\$_____ per unit

OS&Y Gate Valve, 8" with temper switch	\$_____ per unit
OS&Y Gate Valve, 10" with temper switch	\$_____ per unit

1.7 UNIT PRICES - ELECTRICAL CONSTRUCTION: Materials in Place.

Power outlet (duplex or quadraplex), including outlet boxes and wiring. Receptacles will generally be connected within 10' of adjacent receptacle circuits, at locations as directed by Professional	\$_____ per unit
Exterior weatherproof duplex power receptacle including up to 100 feet of (2)#12, (1)#12G, in 3/4" conduit	\$_____ per unit
Fire Alarm System - Smoke Detector Device, including outlet box and 100 linear feet of wiring	\$_____ per unit
Fire Alarm System - Heat Detector Device, including outlet box and 100 linear feet wiring	\$_____ per unit
Fire Alarm System – Tamper Switch interface device	\$_____ per unit
Fire Alarm System – Flow Switch interface device	\$_____ per unit
Fire Alarm system wiring	\$_____ per lin. ft.
Fire Alarm system programming	\$_____ per Fire Alarm point
Temporary removal, support & re-installation of 2'x4' light fixture including wiring.	\$_____ per unit

END OF SECTION 011510

SECTION 011600 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General product requirements, including:
 - a. General specification requirements for all products.
 - b. Product options.
 - c. Procedures for substitution requests.
 - d. General requirements and procedures for maintenance materials and tools.
2. General requirements for product documentation, including:
 - a. Requirements and procedures for schedule of products.
 - b. Requirements for operation and maintenance data.
 - c. General requirements for warranties.
3. General procedures for products including:
 - a. Procedures for transportation and handling.
 - b. Procedures for delivery and receiving.
 - c. Procedures for storage.
 - d. General procedures for installation.
4. Electronic documentation of operations and maintenance data.

1.2 DEFINITIONS

A. Damage:

1. Includes:
 - a. Breakage.
 - b. Marring of finish.
 - c. Deterioration due to moisture.
 - d. Deterioration due to humidity.
 - e. Bending.
 - f. Over-stressing.
 - g. Discoloration.
 - h. Permanent soiling.
 - i. Deterioration beyond limits expected in the finished building.

1.3 SUBMITTALS

- A. Schedule of Products: Submit for approval.
- B. Final Schedule of Products: Submit for project record.
- C. Operations and Maintenance Data: Submit for information only.
- D. Electronic Documentation of Operations and Maintenance Data: Submit for information only.
- E. Warranties: Submit for project record.
- F. Receipts for maintenance materials and tools.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Components required to be supplied in quantity within a specification section shall be identical, interchangeable, and made by the same manufacturer.
- B. Do not use products removed from existing construction, unless specifically permitted by the contract documents or approved by the Consulting Engineer.

2.2 MAINTENANCE MATERIALS AND TOOLS

- A. Maintenance Materials:
 - 1. Parts and materials for repair and maintenance.
 - 2. Specific items required are specific in product sections.
 - 3. Provide products and tools which are identical to those used in the work.
 - a. If necessary, order at the same time as products to be installed or tools to be used in the work.
- B. Package appropriately and label to show type and quantity of contents.
- C. Deliver, handle, and store in the same manner as products to be installed.
- D. Do not turn over to the Owner until date of substantial completion, unless otherwise requested by the Consulting Engineer.
- E. Deliver to the Owner and unload.
- F. Obtain receipt prior to final payment.

PART 3 - EXECUTION

3.1 PRODUCT OPTIONS

- A. It is the Contractor's responsibility to select products which comply with the contract documents.
- B. It is the Contractor's responsibility to select products which are compatible with one another.
- C. Verify that electrical characteristics of products are compatible with electrical systems.
 - 1. Notify Consulting Engineer of discrepancies.
- D. Where visual matching to an established physical sample is required, the Consulting Engineer's decision will be final.
- E. No substitute products will be considered, except in the event of unavailability of the specified product through no fault of the Contractor.
- F. Definition of Substitute Product: Any product which does not meet the requirements of the contract documents, whether in the following is considered a substitute:
 - 1. Product characteristics.
 - 2. Performance.
 - 3. Quality.
 - 4. Manufacturer.
 - 5. Brand name.
- G. Product Options: Where products are specified using more than one method, such as description with a list of manufacturers, use a product meeting the requirements of both specification methods.
- H. Products Specified by Reference Standard:
 - 1. Use any product meeting the specification.
 - 2. Provisions of reference standards shall not modify the rights of the Owner defined in the contract documents.
- I. Products Specified by Description: Use any product meeting the specification.
- J. Products Specified by Performance Requirements: Use any product meeting the specification.
- K. Products Specified by Listing Brand Name(s): Provide one of the products listed.
 - 1. No substitutions will be allowed.
- L. Products Specified by Listing Manufacturer(s): Provide a product meeting the specification and made by one of the manufacturers listed.

3.2 SUBSTITUTION PROCEDURE

- A. Refer to Special Conditions Section - Substitution of Material.
- B. Submission of request for substitution shall constitute a representation by the Contractor that he:
 - 1. Has investigated the proposed product and determined that it is equal to or better than the specified product in all respects.
 - 2. Will provide the same warranty for the proposed product as for the specified product.
 - 3. Will coordinate the installation and make other changes which may be required for the work to complete in all respects, including:
 - a. Redesign.
 - b. Additional components and capacity required by other work affected by the change.
 - 4. Waives all claims for additional costs and time extensions which subsequently may become apparent and which are caused by the change.
 - 5. Will reimburse the Owner for additional costs for evaluation of the substitution request, redesign if required, and reapproval by authorities having jurisdiction if required.
- C. Substitutions will not be considered when acceptance would require substantial revision of the contract documents.
- D. Substitutions will not be considered when they are indicated or implied on shop drawing submittals without separate, explicit written request.
- E. Substitutions will not be considered when they are indicated or implied on product data submittals without separate, explicit written request.
- F. Substitution requests will not be considered when submitted directly by subcontractor or supplier.
- G. Substitution Request Procedure:
 - 1. Submit written request with complete data substantiating compliance of the proposed product with requirements of the contract documents.
 - 2. Submit request to the Consulting Engineer.
 - 3. Submit 6 copies of each request and accompanying data.
 - 4. Submit request as specified for change order proposals. See Section 011025.
 - 5. Only one request for substitution will be considered for each product.
- H. Data Required with Substitution Request: Provide at least the following data:
 - 1. Identify product by specification section and paragraph number.
 - 2. Provide manufacturer's name and address, trade name and model number of product (if applicable), and name of fabricator or supplier (if applicable).
 - 3. Include complete product data.
 - 4. Include an itemized comparison of the proposed product to the specified product.
 - 5. Give amount of net change to the contract sum.
 - 6. List availability of maintenance services and replacement materials.

7. State the effect of the substitution on the construction schedule.
8. Describe changes that will be required in other work or products if the substitute product is approved.

- I. The Consulting Engineer will determine acceptability of the proposed situation.
- J. when the proposed substitution is not accepted, an addendum will be issued to all prospective bidders. Strict adherence to time limit shall be required.

3.3 SCHEDULE OF PRODUCTS

- A. Prepare a complete schedule of products used, including the following for each product:
 1. Name of manufacturer.
 2. Brand or trade name.
 3. Model number, if applicable.
 4. Reference standard, if more than one is applicable.
 5. Arrange products in the schedule by specification sections; indicate paragraph where specified.
- B. Prepare and submit an initial schedule within 10 working days after award of the contract.
 1. Resubmit when revised.
 2. Submit final schedule prior to final payment.
- C. Schedule of products shall not be used to obtain approval of substitute products.
 1. Make separate, explicit request for substitution.
 2. Submit request as specified for change order proposals. See Section 011025.

3.4 OPERATION AND MAINTENANCE DATA

- A. Provide operation and maintenance data for the types of products listed below and for other products if indicated in individual product sections.
 1. Provide data sufficient for operation and maintenance by Owner without further assistance from the manufacturer.
 2. Provide completed data in time for use during Owner instruction.
- B. Data Required For Products:
 1. Name of manufacturer and product.
 2. Name, address, and telephone number of subcontractor or supplier.
 3. Local source of replacements.
 4. Local source of replaceable parts and supplies.
 5. List of installed locations.
- C. Product Data:
 1. Where product data is specified for inclusion in operation and maintenance data:

- a. Provide manufacturer's data sheets marked to indicate specific product and product options actually installed.
 - b. Delete inapplicable data.
 - c. See Section 011300.
- D. Custom Manufactured Products:
 1. Provide sufficient information for reordering.
 2. Provide shop drawings.
- E. Finish Materials:
 1. Provide manufacturer's product data.
 2. Provide color/texture designations.
- F. Provide manufacturer's instructions for care, cleaning, and maintenance.
- G. Equipment:
 1. Provide at least the following information:
 - a. Product data giving equipment and function description.
 - 1) Normal operating characteristics.
 - 2) Limiting conditions.
 - b. Starting.
 - c. Operating.
 - d. Troubleshooting procedures.
 - e. Cleaning and maintenance requirements and procedures.
 - f. External finish maintenance requirements.
 - g. List of maintenance materials required.
 - h. List of special tools required.
 - i. Parts list:
 - 1) List all replaceable parts.
 - 2) Include ordering data.
 - j. Recommended quantity of spare parts to be maintained in storage.
 - k. Recommended maintenance schedule.
- H. Systems: Provide overall function description, with diagrams, prepared especially for this project.
- I. Prepare data in the form of an instructional manual.
 1. Arrange content logically, using section numbers and sequent of sections indicated on the table of contents of this project manual.
 2. When multiple volumes are used, arrange by related subjects; identify contents in cover title.
 3. Assemble into 3-ring binders with maximum 2-inch ring size.

- a. Hardback, cleanable plastic covers.
 - b. Identify each book with title "Operation and Maintenance Instructions: and project name.
 - c. Page size 8-1/2 inches by 11 inches.
 - d. Prepare special typewritten data on minimum 20-pound paper.
 - e. Provide tabbed divider for each product and system.
 - f. Bind drawings in with other data.
 - 1) Provide reinforced binding edge.
 - 2) Fold larger drawings to size of pages.
 - 3) Do not use pockets or loose drawings.
 4. Provide table of contents for each volume listing:
 - a. Name of the project.
 - b. Name, address, telephone number, and contact name of:
 - 1) Contractor.
 - 2) Supplier.
 - 3) Manufacturer's representative.
 - c. Index of products and systems included in volume.
 5. Provide one (1) hard copy of printed instructions to the Engineer upon completion of installation.
 - a. Provide in accordance with Division 1, Section 011025.
 - b. Provide copies of the as-built drawing in the manual.
- J. Electronic Documentation of Operations and Maintenance Data:
1. Contractors are required to duplicate the entire operation and maintenance data issued in the hard copy submission and prepare an electronic version of the documentation.
 2. The electronic documentation will be submitted on a CD of quantities required for the project. The CD's are to be filled to maximum capacity to minimize the quantities issued. Where a tab/directory and included data files are separated between two disks, the entire director shall be moved to the next disks. If the directory exceeds the capacity of one disk, then separation is acceptable.
 3. The CD's shall be labeled as Volume 1 of _____ and must include the title "Operation & Maintenance Instructions", project name, project numbers and project date.
 4. The operation and maintenance data files must be of Portable Document Format (pdf) file type. No other file format will be acceptable. Preparation of files can be accomplished through conversion, scanning, and downloading of files in the pdf format. Portable document format files are to be of current software version.
 5. Document files must be uniquely named to indicate product and grouped into associated directory, similar to hard copy tab separation. Directories must be uniquely named to indicate system reference. The directories are to be organized similar to hard copy. Provide a typed table of contents in pdf format to be located as the first file on the CD of Volume 1.
 6. Contractors are to submit the CD's to Consulting Engineer for review and approval.

3.5 WARRANTIES

- A. Provide warranties as specified in individual product sections.
- B. Manufacturer Warranties:
 - 1. Provide manufacturer's standard product warranty:
 - a. Running for the manufacturer's standard term, unless otherwise indicated in section associated with each item.
 - b. Starting on the date of Substantial Completion.
 - 2. Submit copies of all manufacturer warranties which extend beyond the end of the contract correction period.
- C. Provide 2 notarized copies of each executed warranty.
- D. Each warranty shall list actual date of commencement.
 - 1. No earlier than the date of Substantial Completion.

3.6 TRANSPORTATION AND HANDLING

- A. Require supplier to package finished products in a manner which will protect from damage during shipping, handling, and storage.
- B. Transport products by methods which avoid damage.
- C. Deliver in dry, undamaged condition in manufacturer's unopened packaging.
- D. Provide equipment and personnel adequate to handle products by methods which prevent damage.
- E. Provide additional protection during handling where necessary to prevent damage to products and packaging.
- F. Lift large and heavy components at designated lift points only.

3.7 DELIVERY AND RECEIVING

- A. Arrange deliveries of products to allow time for inspection prior to installation.
- B. Coordinate delivery to avoid conflict with the work and to take into account both the conditions at the site and the availability of personnel, handling equipment, and storage space.
- C. Clearly mark partial deliveries to identify contents, to permit easy accumulation of entire delivery, and to facilitate assembly.

- D. Promptly inspect shipments and remedy damage, incorrect quantity, incompleteness, improper or illegible labeling, and noncompliance with requirements of contract documents and approved submittals.

3.8 STORAGE

A. General Storage Procedures:

1. Store products immediately on delivery.
2. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
3. Store in a manner to prevent damage to the stored products and to the work.
4. Store moisture-sensitive products in weather-tight enclosures.
5. Maintain temperature and humidity within ranges required by manufacturer's instructions.
6. Store unpacked and loose products on shelves, in bins, or in neat groups of like items. Arrange storage to provide access for inspection and inventory.
7. Periodically inspect and remedy damage and noncompliance with required conditions.

B. Loose Granular Materials:

1. Store on solid surfaces in well-drained area.
2. Prevent mixing with foreign materials.

C. Exterior Storage:

1. Cover products subject to weather damage with impervious sheet covering.
 - a. Provide ventilation to avoid condensation.
2. Provide surface drainage to prevent water from damaging stored products.
3. Prevent damage and contamination from:
 - a. Refuse.
 - b. Chemically injurious materials.
 - c. Chemically injurious liquids.
4. Store fabricated products on substantial platforms or skids above the ground, sloped to drain.

3.9 INSTALLATION

- A. Obtain manufacturer's standard, printed instructions.
- B. Obtain additional recommendations from the manufacturer.
 1. Recommendations shall be written.
- C. Install products in accordance with manufacturer's instructions and recommendations.

- D. Adjust all products to proper operation.

END OF SECTION 011600

SECTION 011700 - CONSTRUCTION PROCEDURES

PART 1 - GENERAL

1.1 DEFINITIONS

A. Cutting: removal of material by:

1. Cutting.
2. Sawing.
3. Drilling.
4. Breaking.
5. Chipping.
6. Grinding.
7. Similar operations including excavation.

B. Damage:

1. Deterioration whether due to:
 - a. Weather.
 - b. Normal wear and tear.
 - c. Accident.
 - d. Abuse.
2. Deterioration resulting in:
 - a. Soiling.
 - b. Marring.
 - c. Breakage.
 - d. Corrosion.
 - e. Impairment of function.

C. Debris:

1. Includes:
 - a. Rubbish.
 - b. Waste materials.
 - c. Litter.
 - d. Volatile wastes.
 - e. Similar materials.
2. Does not include surplus materials which are to become the property of the Owner.

D. Fire Barriers: Includes the following, when indicated as having a fire resistance rating:

1. Wall.

2. Floor.
3. Ceiling.
4. Roof.

E. Operational Elements:

1. Elements which convey the following elements which retard the passage of:
 - a. Liquids.
 - b. Gases.
 - c. Heat.
 - d. Light.
 - e. Persons.
 - f. Animals.
 - g. Insects.
 - h. Elements which perform a similar function.
2. Includes the following:
 - a. Equipment.
 - b. Moving parts.
 - c. Electrical conductors.
 - d. Sound and vibration control materials.
 - e. Waterproofing.
 - f. Vapor retarders.
 - g. Piping.
 - h. Ducts.
 - i. Other similar products.

F. Patching: Restoration to completed condition by:

1. Patching.
2. Repairing.
3. Refinishing.
4. Finishing.
5. Filling.
6. Closing up.
7. Similar operations.

G. Replacement: Replace the entire Element/Surface/Product.

H. Safety-Related Elements:

1. Materials and assemblies whose principal function is the promotion of the safety of:
 - a. The building.
 - b. Its occupants.
2. Includes:
 - a. Fire barriers.

- b. Smoke barriers.
- c. Fireproofing.
- d. Emergency egress doors.
- e. Emergency egress windows.
- f. Guardrails.
- g. Equipment guards.
- h. Other similar construction.

1.2 SUBMITTALS

A. Proposals for Cutting and Patching:

- 1. Submit request well in advance of the time the work is to be performed.
- 2. Include the following information:
 - a. Description of the nature of the work.
 - b. How it is to be performed.
 - c. Reasons why cutting cannot be avoided.
 - d. Description of anticipated results.
 - e. Impact on safety and on:
 - 1) Structural qualities.
 - 2) Operational qualities.
 - 3) Visual qualities.
 - f. Products to be used.
 - g. Expected dates of performance of the work.

B. Start-up Reports:

- 1. Submit within 5 business days after start-up of item covered by report.
- 2. Include a statement certifying the item has been installed properly and is functioning correctly.
- 3. Include the following information:
 - a. Item started up.
 - b. Date of start-up operation.
 - c. Entity performing start-up.
 - d. Applicable specification section.
 - e. Results of start-up.
 - f. Title, name, and signature of person performing start-up.
 - g. Title, name, and signature of person authorized to make certification.

C. Demonstration Reports:

- 1. Submit within 5 business days after each demonstration.
- 2. Include the following information:
 - a. Description of equipment demonstrated, cross-referenced to the contract documents.

- b. Description of system demonstrated, cross-referenced to the contract documents.
- c. Date of demonstration.
- d. Name and title of person performing demonstration.
- e. Name, title, and signature of person observing demonstration.

D. Instruction Reports:

- 1. Submit with 5 business days after each instruction period.
- 2. Include the following information:
 - a. Description of instruction provided, cross-referenced to the contract documents.
 - b. Date(s) and duration of instruction.
 - c. Location where instruction was provided.
 - d. Names and titles of persons performing instruction.
 - e. Names, title, and signatures of persons receiving instruction.

E. Field Correction Requests:

- 1. Submit immediately upon discovery of deviation required.
- 2. Include a detailed statement of:
 - a. The problem.
 - b. Recommended changes.
 - c. Reasons for noncompliance with the contract documents.

1.3 QUALITY ASSURANCE

A. Cleaning Agents:

- 1. Use only cleaning agents which are recommended by the manufacturer/fabricator of the surface to be cleaned.
- 2. Do not use materials which are potentially hazardous to:
 - a. Health.
 - b. Property.
- 3. Do not use materials which might damage finishes.
- 4. Perform cleaning in accordance with the recommendations of the manufacturer/fabricator of the product or system.
 - a. Follow standard printed instructions.
 - b. Adjust procedures as recommended in writing by the manufacturer/fabricator.

1.4 PROJECT CONDITIONS

- A. Some areas of existing building will be occupied during the period in which the work will be conducted.
 - 1. Avoid interference with use of those areas.

2. Avoid interruption of access to those areas.
3. Do not obstruct required exitways unless alternative exitways satisfactory to the authorities having jurisdiction are available.

1.5 PROJECT REQUIREMENTS

A. Take precautions to prevent fires.

1. Store combustible materials in containers in fire-safe locations.
2. Remove flammable waste.
3. Prohibit smoking.
 - a. Be extra diligent to prevent smoking in hazardous fire exposure areas.
4. Provide supervision of potential fire sources.
5. Conduct welding operations in manner to prevent fire.
 - a. Comply with local regulations.

B. Take steps to facilitate fire-fighting operations.

1. Maintain unobstructed access to:
 - a. Fire extinguishers.
 - b. Temporary fire protection facilities.
 - c. Stairways.
 - d. And other access routes for fighting fires.
2. Assure that workers are familiar with operation of fire extinguishers.

C. Take precautions to prevent accidents due to physical hazards:

1. Provide:
 - a. Barricades.
 - b. Warning lights.
 - c. Signs to inform of the hazard being protected against.
2. Provide safety barricades in compliance with regulations.
3. Provide temporary walkways where walking surfaces are hazardous.
4. Notify the Consulting Engineer before beginning work that involves hazardous operations.

D. Take steps to assure the environment is not contaminated.

1. Conduct construction in manner to comply with environmental protection regulations.
2. Protect waterways, limit effluent and rainwater runoff by regulations.
3. Do not dump contaminants in areas that will result in contamination of waterways.

E. Restore sewers to normal condition following use.

1. Where disposal of effluent by means of sewers is not possible, provide alternative methods of disposal.
 - F. Protect existing property indicated to remain.
 - G. Do not use tools or equipment which produce harmful levels of noise.
 1. Restrict use of noise-making tools and equipment to times approved by the Owner.
 - H. Do not allow the following to develop at the site:
 1. Nuisances.
 2. Hazardous conditions.
 3. Dangerous conditions.
 4. Unsanitary conditions.
 - I. Keep grounds free of debris due to this work.
 - J. Provide adequate traffic control by means of signs, signals, and flagmen, as necessary.
 - K. Conduct construction operations so that the existing facilities are not subjected to deleterious influences.
 - L. Conduct construction operations so that the project is not subjected to deleterious influences.
 - M. Conduct construction operations to minimize use of:
 1. Power.
 2. Water.
 3. Fuel.
 - N. Provide temporary supports as required to prevent building movement.
 - O. Install products only during environmental conditions which will ensure the best possible results.
- 1.6 SEQUENCING AND SCHEDULING
- A. Install products only at the time and in the sequence which will ensure the best possible results.
 - B. Coordinate timing of required administrative procedures with construction activities to avoid conflicts and to ensure orderly progress of the work.

PART 2 - PRODUCTS

2.1 MATERIALS FOR PATCHING

- A. Use materials that are identical to the materials of the work cut, unless specific materials are specified in other sections.
- B. Use exposed materials identical to those of the adjacent construction for closing up openings.
 - 1. If identical materials are not available or cannot be used, use materials that match visually to the fullest extent possible; obtain approval of the Consulting Engineer.
- C. Use materials that perform equally as well as, or better than, the material cut.
- D. Determined by testing, if necessary, quality of existing materials to be patched.

PART 3 - EXECUTION

3.1 GENERAL EXAMINATION REQUIREMENTS

- A. Prior to performing work, examine:
 - 1. The applicable substrates.
 - 2. The conditions under which the work is to be performed.
- B. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding.
- C. Conditions which could have been discovered by examination will not be allowed as cause for claims for extra work.
- D. Notify the Consulting Engineer promptly of modifications required due to existing conditions or previous work.
- E. Before starting work which might affect existing construction, verify the existence and location of such construction.
 - 1. The existence and location of construction indicated as existing on the drawings is not guaranteed.
- F. Verify that utility requirements of operating equipment are compatible with building utilities.
- G. Verify that space requirements of items, which are shown diagrammatically on the drawings, are compatible with the design.

3.2 GENERAL PREPARATION REQUIREMENTS

- A. Take field measurements to assure work fits properly.
- B. Recheck measurements and dimensions prior to starting each installation.

3.3 GENERAL INSTALLATION PROCEDURES

- A. Install work true to line and level.
- B. See sections describing specific parts of the work for additional requirements.
- C. Where available space is limited, install components to maximize space available for maintenance.
- D. Where available space is limited, to maximize space available for ease of removal for replacement.
- E. Install work in such manner and sequence to minimize cutting and patching.
- F. Do not cut fire extinguishing systems.
- G. Existing Construction:
 - 1. Perform work in existing construction in same manner as for new construction unless otherwise specified.
- H. Keep the site and the work free of waste materials and debris.
 - 1. Remove waste from site periodically.
 - 2. Handle the following materials separately from other materials and containerize properly:
 - a. Hazardous waste materials
 - b. Dangerous waste materials.
 - c. Unsanitary waste materials.
- I. Clean areas to level of cleanliness necessary for proper execution of that work.
 - 1. Where dust would impair execution of work, keep clean by broom cleaning and vacuum cleaning the entire interior area.
- J. Keep installed work clean, and clean again when soiled by other operations.
 - 1. Provide periodic cleaning to prevent damage due to soiling.
 - 2. Remove liquid spills promptly.
- K. Protect installed work from soiling and damage.
 - 1. Provide protective coverings.
 - 2. Provide protective coverings for work which may be damaged by subsequent operations.

3. Where heavy abuse is expected, use minimum of 3/8 inch thick plywood for protection.
4. Maintain coverings until substantial completion.

L. Adjust operating components for proper operation.

3.4 CUTTING AND PATCHING PROCEDURES

- A. Use specified cutting and patching procedures when either cutting, patching, or cutting and patching is required for any of the following activities:
1. Fitting the parts of the work together.
 2. Modifying existing construction.
 3. Repairing existing work to remain.
 4. Installing ill-timed work.
 5. Removing and replacing defective and nonconforming work.
 6. Making openings in elements of work for penetrations, such as for:
 - a. Ductwork
 - b. Piping.
 - c. Conduit.
 7. Repairing damage.
- B. Perform cutting and patching at earliest, feasible time, unless otherwise directed by the Consulting Engineer.
- C. Use procedures specified in applicable product sections as well as those specified in this section.
1. Use procedures recommended by original installer, when such information is available.
 2. Obtain, from the Consulting Engineer, approval of procedures.
 3. Cut using methods which:
 - a. Are least likely to damage adjacent work and work to remain.
 - b. Will provide proper surfaces for patching.
 4. Make cuts neatly with minimum disturbance of adjacent work.
 - a. Use tools designed for sawing/grinding, not for chopping/hammering.
 - b. Without prior approval, do not use pneumatic tools.
 5. Where installation of similar new work is included, perform patching in manner specified for installation of new work.
- D. Employ experienced workers to perform cutting and patching work.
1. Use the original installer of the work to perform cutting and patching of the following:
 - a. Any products so indicated in the applicable section.
 - b. Roofing.

E. Structural Elements:

1. Do not cut structural elements without providing certification of approval from a structural engineer licensed in the Commonwealth of Pennsylvania.
2. Do not cut structural elements without Consulting Engineer's approval.
3. Do not cut or patch in a manner that would result in a reduction of load-carrying capacity.
4. Do not cut or patch in a manner that would result in a reduction of load- deflection ratio.
5. Provide reinforcing where required.
6. See structural sections for additional requirements.

F. Existing Construction:

1. Patch existing work to match adjacent, existing work to remain.
2. Where specified procedures for similar, new work are applicable, use those procedures for cutting and patching existing construction.
3. Take precautions to avoid damage to unanticipated utilities and structural elements.
4. If such elements are encountered report nature and extent to the Consulting Engineer.
 - a. Request instructions as to how to proceed.
5. Do not cut existing mechanical and electrical services without provisions for prompt reactivation of service.
 - a. Obtain approval of the Owner for the time and duration of disconnection.

G. Concrete and masonry:

1. Use saws or drills which produce a neat cut.
2. Remove in small sections.

H. Slabs on Grade: Use methods that will not crack or disturb adjacent slabs or partitions.

I. Operational Elements:

1. Do not cut or patch in a manner that would result in:
 - a. Reduction of their capacities to perform in the manner intended.
 - b. Reduction of their energy performance.
 - c. Increased maintenance.
 - d. Decreased life.
 - e. Decreased safety.
2. Before cutting the following, obtain the Consulting Engineer's approval of proposed method:
 - a. Any product for which approval is required in the applicable product section.
 - b. Piping, wiring, ducts, mechanical and electrical equipment.

J. Safety-Related Elements:

1. Do not cut or patch in a manner that would result in decreased safety.

K. Fire/Smoke Barriers.

1. Do not cut more than absolutely necessary.
2. Cut penetration holes to sizes required for penetration seal assemblies.
3. Patch all oversize holes and cuts made in error.
4. Perform patching in a manner which complies in all respects with the original construction.
 - a. If such compliance is not possible, report nature of difficulty to the Consulting Engineer and request instructions.

L. Provide protection from adverse weather conditions for that part of the project which is exposed to the weather during cutting and patching operations.

M. Cover openings made whenever they are not in use.

3.5 INSTALLATION OF COMPONENTS

- A. Separate incompatible materials with suitable materials or spacing to prevent cathodic corrosion.
- B. Provide attachment and connection devices and use methods necessary to securely fasten work.

3.6 PROCEDURES FOR CORRECTION OF WORK

- A. The following must be replaced (repair is not acceptable):
 1. Damaged surfaces exposed to view which cannot be repaired without visible evidence of repair.
 2. Components which cannot be repaired to proper operating condition.
- B. Repair or Replace:
 1. Components which do not operate properly.
 2. Surfaces exposed to view which cannot be cleaned to original condition.
 3. Permanent facilities used during construction.
 4. Other defective work.
- C. Acceptable Repair Methods:
 1. Replacing parts.
 2. Refinishing.
 3. Touching up with matching materials.
 4. Proper adjustment of equipment.
- D. When corrective action required necessitates a departure from the contract documents, submit a field correction request.
 1. Do not proceed with requested action without Consulting Engineer's approval.

- E. Restore existing facilities used during construction to specified condition.
- F. Restore existing facilities used during construction, and existing facilities affected by construction operations, to original condition.

3.7 FACILITY START-UP

- A. Put each item of equipment and each system into full, satisfactory operation.
- B. Prior to Start-up:
 - 1. Verify that equipment and systems are:
 - a. Complete.
 - b. Correctly connected to utilities.
 - c. Tested.
 - d. Comply with requirements of manufacturer.
 - 2. Inspect and test to ensure that work is installed as specified and to determine suitability for energizing.
 - 3. Provide power for start-up and testing.
 - 4. Change over from temporary to permanent utility sources.
 - 5. Adjust and lubricate operating components to ensure smooth and unhindered operation, check:
 - a. Drive rotations.
 - b. Belt tension.
 - c. Control sequences.
 - d. Other features which might cause damage if not properly adjusted.
 - 6. When required by manufacturer, have manufacturer's representative prepare for start-up.
- C. Notify the Consulting Engineer at least 10 business days prior to start-up of each item and system.
- D. Execute start-up under supervision of responsible personnel in accordance with the manufacturer's instructions.
 - 1. When specified, have manufacturer's representative perform start-up.
 - 2. When required by manufacturer, have manufacturer's representative perform start-up.
 - 3. Submit a written report of start-up operations.
- E. After start-up, adjust equipment and systems for proper operation.
 - 1. Where specified, perform tests or inspections to determine status of operation.
- F. During the inspection for substantial completion, demonstrate the operation of equipment and systems to the Owner.
 - 1. Have final operating and maintenance data available during demonstration.

- G. For equipment and systems which operate differently in different seasons, demonstrate operation during subsequent seasons until fully demonstrated.

3.8 INSTRUCTION OF THE OWNER'S PERSONNEL

- A. Prior to final payment, instruct Owner's designated personnel in the operation and maintenance of equipment and systems.
 - 1. Explain all aspects of operation and maintenance.
 - 2. Demonstrate all functions, including:
 - a. Start-up.
 - b. Operation.
 - c. Control.
 - d. Adjustment.
 - e. Troubleshooting.
 - f. Servicing.
 - g. Maintenance.
 - h. Shutdown.
 - 3. Review terms of warranties and procedures for obtaining warranty service.
 - 4. Review maintenance agreements and other similar commitments which extend past final completion.
 - 5. Have operating and maintenance data available for use during instruction.
 - a. Review contents in detail.
 - b. Prepare and insert additional data when need for such becomes apparent during instruction.
- B. Arrange times and places of instruction with the owner.
 - 1. Provide a minimum of 1 hour of instruction for each item of equipment and each system, unless otherwise specified.
 - 2. Instruct in a classroom environment located at the project.
- C. Provide instruction by a qualified manufacturer representative.
- D. For equipment and systems which operate differently in different seasons, provide instruction during subsequent seasons until all modes of operation have been covered.

3.9 FINAL CLEANING

- A. Remove materials and equipment which are not part of the work.
- B. Remove debris from the site prior to substantial completion.
 - 1. Remove all surplus materials which are to remain property of the Contractor.
 - 2. Obtain the Owner's instructions as to disposition of surplus material remaining on site, then as directed:

- a. Deliver.
 - b. Store.
 - c. Dispose of.
- 3. Remove protective coverings.
- 4. Remove temporary facilities.
- C. Dispose of debris in a lawful manner.
 - 1. Do not burn or bury debris on the site.
 - 2. Do not dispose of volatile wastes in storm or sanitary drains.
- D. Perform final cleaning after substantial completion has been certified, but before final payment.
- E. Remove debris from roofs, gutters, downspouts, and roof drains.
- F. In spaces not normally occupied, remove debris and surface dust and wipe equipment clean, removing excess lubrication, paint, and other foreign substances.
- G. Remove paint and other coatings from labels such as "UL" labels, and from mechanical and electrical equipment nameplates.
- H. Leave the project clean and ready for occupancy.

3.10 PROJECT COMPLETION PROCEDURES

- A. Prior to substantial completion, complete the work to obtain consent to occupancy from the authorities having jurisdiction.
- B. Arrange for final inspections by authorities having jurisdiction to be accomplished prior to substantial completion.
- C. If temporary locking systems differ from permanent locking systems, change over to permanent systems prior to substantial completion.

END OF SECTION 011700

SECTION 011800 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project record documents consisting of:
 - a. Record drawings.
 - b. Record project manual (specifications).
 - c. Record submittals:
 - 1) Shop drawings.
 - 2) Product data.
 - 3) Samples.
 - 4) Informational submittals.
 - 5) All other submittals.
2. Electronic Project Record Submission

1.2 SUBMITTALS

A. Project Record Documents: Submit after substantial completion, but prior to final completion.

1. Record drawings:
 - a. Submit original marked-up print set.
 - b. Sets shall include all drawings, whether changed or not.
2. Other record documents: Submit originals or good quality photocopies.
3. Electronic CD Project Record Submission of record drawings and record documents.

1.3 QUALITY ASSURANCE

- A. Record drawings shall be prepared by an experienced drafter.
- B. Prepare using standard tools and methods used in an engineering office.
- C. Prepare using same drafting symbols and conventions employed on the original, contract drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 MAINTENANCE OF PROJECT RECORD DOCUMENTS

- A. Do not use record documents of any type for construction purposes.
- B. Maintain record documents in a secure, fire-resistive location at the site.
 - 1. Provide for access by the Contractor and the Consulting Engineer during normal working hours.
- C. Record information as soon as possible after it is obtained.
- D. Assign a person responsible for maintaining record documents.
- E. Record the following types of information on all applicable record documents:
 - 1. Dimensional changes.
 - 2. New and revised details.
 - 3. Actual routings of piping and conduits.
 - 4. Revisions to electrical circuitry.
 - 5. Actual equipment locations.
 - 6. Particulars on concealed products which will not be easy to identify later.
 - 7. Changes made by modifications to the contract; note identification numbers if applicable.
 - 8. New information which is important to the Owner but which was not shown in either the contract documents or submittals.

3.2 RECORD DRAWINGS

- A. Maintain a complete set of opaque prints of the contract drawings, marked to show changes.
- B. Where the actual work varies appreciably from that shown on the drawings, mark this set to show the actual installation.
 - 1. Pay particular attention to concealed elements that would be difficult to measure and record at a later date.
 - 2. Mark the drawing and verify prior to covering concealed elements.
 - 3. Mark whichever drawings are most capable of showing the changed conditions fully and accurately.
 - 4. Where changes are marked on record shop drawings, mark cross-reference on the applicable contract drawing.
- C. When the Contractor is required by a provision of a modification to prepare a new drawing, rather than to revise existing drawings, consult with the Consulting Engineer as to:
 - 1. The proper scale.
 - 2. Scope of detailing.

3. Notations required to record the actual work.
 4. Notations required to record actual work's relationships to other construction.
- D. Keep drawings in manageable, bound sets.
1. Provide identification on the cover of each set.
 2. Mark with red, erasable pencil.
 3. Mark variations in work of separate contracts with different colors of erasable pencils.
 4. Use an accurate, appropriate drawing technique.
 5. Incorporate new drawings into existing sets, as they are issued.
- E. Prepare a full set of transparencies of contract drawings with all record changes marked.
- F. Where record drawings are also required as part of operation and maintenance data submittals, make copies from the original record drawing set.

3.3 RECORD PROJECT MANUAL

- A. Maintain a complete copy of the project manual, marked to show changes.
- B. Where the actual work varies from that shown in the project manual, mark the record copy to show the actual work.
1. Include a copy of each addendum and modification to the contract.
 2. In addition to the types of information required on all record documents, record the following types of information:
 - a. Product options taken when the specification allows more than one.
 - b. Product substitutions.
 - c. Proprietary name and model number of actual products furnished, for each product, material, and item of equipment specified.
 - d. Name of the supplier and installer, for each product for which neither a product data submittal nor a maintenance data submittal was specified.

3.4 RECORD SUBMITTALS

- A. Maintain a complete set of all submittals made during construction.
1. Marked to show changes.
 2. Maintain submittals in cardboard file boxes.
 - a. Label to show contents.
 3. Sort submittals by applicable specification section.
 4. File in order of submittal identification number.
- B. Record Shop Drawings:
1. Record the types of information specified for all record documents.

2. Mark changes on record shop drawings only when contract drawing would not be capable of showing the change clearly or completely.
3. Mark changes in manner specified for record drawings.

C. Record Product Data Submittals:

1. Record the types of information specified for all record documents.
2. In addition, record the following types of information:
 - a. Changes in the products after delivery to the site.
 - b. Changes in the manufacturer's instructions or recommendations for installation.

D. Record Coordination Drawings:

1. Record the types of information required for all record documents.
2. Mark up in the manner specified for record drawings.

3.5 ELECTRONIC DOCUMENTATION OF PROJECT RECORDS DATA:

- A. Contractors are required to duplicate the Project Record Documents issued in the hard copy submission and prepare an electronic version of the documentation. The Project Record Documents are to include the following:
1. Record Drawings: Complete as-built drawing matching record set as prepared in accordance to paragraph 3.2 of this section.
 2. Record Project Manual: Include pages from the project specifications that have been marked to show changes in accordance to paragraph 3.3 of this section.
 3. Record Submittals: Provide all final approval shop drawings including, but not limited to, reviewer comments, product data, performance data, electrical data, manufacturers written comments, product specifications, test data, equipment drawings, materials list, system controls, and CAD drawings in accordance to paragraph 3.4 of this section.
 4. Record Correspondence: Provide documentation such as RFI's with written response, meeting minutes, approved change orders with written work scope and additional documentation that defines the performed work of the project.
- B. The electronic documentation will be submitted on a CD of quantities required for the project. The CD's are to be filled to maximum capacity to minimize the quantities issued. Where a tab/directory and included data files are separated between two disks, the entire directory shall be moved to the next disks. If the directory exceeds the capacity of one disk, then separation is acceptable.
- C. The CD's shall be labeled as Volume 1 of ____ and must include the title "Project Records", project name, project number and project date.
- D. The project records data files must be of Portable Document Format (pdf) file type. No other file format will be acceptable. Preparation of files can be accomplished through conversion, scanning, and downloading of files in the pdf format. Portable document, format files are to be of current software version.

- E. Document files must be uniquely named to indicate product and grouped into associated directory similar to hard copy tab separation. Directories must be uniquely named to indicate system reference. The directories are to be organized similar to hard copy. Provide a typed table of contents in pdf format to be located as the first file on the CD of Volume 1.
- F. Contractors are to submit the CD's to Consulting Engineer for review and approval.

3.6 TRANSMITTAL TO OWNER

- A. Collect, organize, label, and package ready for reference.
 - 1. Provide cardboard file boxes for submittals.
 - 2. Provide cardboard drawing tubes with end caps for transparencies.
 - 3. Bind print sets with durable paper covers.
 - 4. Label each document (and each sheet of drawings) with "PROJECT RECORD DOCUMENTS - This document has been prepared using information furnished by _____", and the date of preparation.
- B. Submit to the Consulting Engineer.

END OF SECTION 011800

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of training.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Engineer.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF format required for operation and maintenance manuals specified in Section 011700 "Construction Procedures."

1.4 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.

- C. Videographer Qualifications: A videographer who is experienced photographing demonstration and training events similar to those required.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Engineer.

1.6 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.
- 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. Training must include operation, adjustments, troubleshooting, maintenance, repairs and emergency procedures.

1.7 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 011700 "Construction Procedures."
- B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

- A. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.

- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

- 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Submit before Work begins.
- E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- 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.
 - 2. If suspected 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.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.9 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
 - 1. Inventory and record the condition of items to be removed and salvaged.
 - 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.3 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

5. Maintain fire watch during and for at least 8 hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
1. Remove existing roof membrane, flashings, copings, and roof accessories.
 2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site.
 - 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.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

1.2 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. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. 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 the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Vapor-retarder installation.
 - e. Anchor rod and anchorage device installation tolerances.
 - f. Cold and hot weather concreting procedures.
 - g. Concrete finishes and finishing.

- h. Curing procedures.
- i. Forms and form-removal limitations.
- j. Methods for achieving specified floor and slab flatness and levelness.
- k. Floor and slab flatness and levelness measurements.
- l. Concrete repair procedures.
- m. Concrete protection.
- n. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
- o. Protection of field cured field test cylinders.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

- 1. Portland cement.
- 2. Fly ash.
- 3. Slag cement.
- 4. Blended hydraulic cement.
- 5. Silica fume.
- 6. Performance-based hydraulic cement
- 7. Aggregates.
- 8. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
- 9. Floor and slab treatments.
- 10. Liquid floor treatments.
- 11. Curing materials.
- 12. Joint fillers.
- 13. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

- 1. Mixture identification.
- 2. Minimum 28-day compressive strength.
- 3. Maximum w/cm.
- 4. Slump limit.
- 5. Air content.
- 6. Nominal maximum aggregate size.
- 7. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
- 8. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
- 9. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
- 10. Intended placement method.
- 11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Engineer.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Floor and slab treatments.
5. Bonding agents.
6. Adhesives.
7. Semirigid joint filler.
8. Joint-filler strips.
9. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:
 - a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

D. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

E. Preconstruction Test Reports: For each mix design.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.
 - 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed 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.
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
- D. Field Quality-Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.8 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1 and as follows.
 - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 2. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
 - 3. Do not use frozen materials or materials containing ice or snow.
 - 4. Do not place concrete in contact with surfaces less than 35 deg F (1.7 deg C), other than reinforcing steel.
 - 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:
 - 1. Maintain concrete temperature at time of discharge to not exceed 95 deg F (35 deg C).
 - 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 ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

- A. Source Limitations:

- 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
 - 2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
 - 3. Obtain aggregate from single source.
 - 4. Obtain each type of admixture from single source from single manufacturer.

- B. Cementitious Materials:

- 1. Portland Cement: ASTM C150/C150M, Type I.
 - 2. Fly Ash: ASTM C618, Class C or F.
 - 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

- C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S aggregate or better, graded. Provide aggregates from a single source.

- 1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm)] nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- D. Air-Entraining Admixture: ASTM C260/C260M.

- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

- 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. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

- F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below 50 deg F (10 deg C): Black.
 - b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
 - c. Ambient Temperature Above 85 deg F (29 deg C): White.

2.4 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: **ASTM D1751, asphalt-saturated cellulosic fiber.**
- B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

2.5 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, in accordance with ACI 301.
 - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 - 1. Fly Ash or Other Pozzolans: 25 percent by mass.
 - 2. Slag Cement: 50 percent by mass.
 - 3. Silica Fume: 10 percent by mass.
 - 4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
 - 5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
 - 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
 - 4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Engineer.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth concrete thickness as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated on Drawings.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
- B. Notify Engineer and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.
- E. 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.
 1. If a section cannot be placed continuously, provide construction joints as indicated.
 2. Deposit concrete to avoid segregation.
 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

3.6 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
 - b. Remove projections larger than 1 inch (25 mm).
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 (ACI 117M) Class D.

B. Rubbed Finish: Apply the following to as cast surface finishes:

1. Smooth-Rubbed Finish:
 - a. Perform no later than one day after form removal.
 - b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
 - c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.

3.7 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.8 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases as indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 16-inch (450-mm) centers around the full perimeter of concrete base.
5. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.9 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
 2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.

3.10 TOLERANCES

- A. Conform to ACI 117.

3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 1. Repair and patch defective areas when approved by Engineer.
 2. Remove and replace concrete that cannot be repaired and patched to Engineer'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 (1.18-mm) 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 (13 mm) in any dimension to solid concrete.
 - a. Limit cut depth to 3/4 inch (19 mm).
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement, so that, when dry, patching mortar matches surrounding color.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces:
 - 1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 3. After concrete has cured at least 14 days, correct high areas by grinding.
 - 4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
 - 5. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete.

- a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar.
- a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 2. Testing agency to immediately report to Engineer, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 3. Testing agency to report results of tests and inspections, in writing, to Owner, Engineer, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.

- 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- C. Inspections:
1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing provides 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:
 - a. 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.
 - b. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Compression Test Specimens: ASTM C31/C31M:

- a. Cast and laboratory cure two sets of four 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
 - b. Cast, initial cure, and field cure two sets of four standard cylinder specimens for each composite sample.
5. Compressive-Strength Tests: ASTM C39/C39M.
- a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
6. 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 (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
7. 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.
8. Additional Tests:
- a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
- 1) Acceptance criteria for concrete strength to be in accordance with ACI 301 (ACI 301M), Section 1.6.6.3.
9. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
10. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.14 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.

7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 STIPULATIONS

- 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. Lintels.
- 3. Brick.
- 4. Mortar and grout materials.
- 5. Reinforcement.
- 6. Ties and anchors.
- 7. Embedded flashing.
- 8. Accessories.
- 9. Mortar and grout mixes.

- B. Products Installed but not Furnished under This Section:

- 1. Steel lintels in unit masonry.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

C. Samples for Verification: For each type and color of the following:

1. Weep holes and cavity vents.
2. Accessories embedded in masonry.

1.6 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. Receipt of list does not constitute 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 data on material properties, material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. 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/C 91M 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 TMS 602/ACI 530.1/ASCE 6.

- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

1.8 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 until they are dry.
- B. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD 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 multiwythe 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/ACI 530.1/ASCE 6.
 - 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/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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.
- B. 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.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, 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. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

2.4 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 square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
 - 2. Density Classification: Normal weight.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.5 LINTELS

- A. Solid Concrete Masonry Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength of not less than that of CMUs.

2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, 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.
 - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91/C 91M.
 - 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. Cemex S.A.B. de C.V.
 - b. Essroc.
 - c. Holcim (US) Inc.
 - d. Lafarge North America Inc.
 - e. Lehigh Hanson; HeidelbergCement Group.
- E. Mortar Cement: ASTM C 1329/C 1329M.

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. Lafarge North America Inc.
- F. Aggregate for Mortar: ASTM C 144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 1. 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. BASF Corporation-Construction Systems.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. Grace Construction Products; W.R. Grace & Co. -- Conn.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
 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. ACM Chemistries.
 - b. BASF Corporation-Construction Systems.
 - c. Euclid Chemical Company (The); an RPM company.
 - d. Grace Construction Products; W.R. Grace & Co. -- Conn.
- J. Water: Potable.

2.7 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dur-O-Wal; a Hohmann & Barnard company.
 - b. Heckmann Building Products, Inc.
 - c. Hohmann & Barnard, Inc.
 - d. Wire-Bond.
- C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Interior Walls: Hot-dip 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 diameter.
 - 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.8 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
- C. 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. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.
- D. 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. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch-thick steel sheet, galvanized after fabrication.

- a. 0.064-inch-thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.
- E. 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, Epoxy coating 0.020 inch (0.51 mm) thick, Rust-inhibitive paint.

2.9 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
 - b. EaCo Chem, Inc.
 - c. PROSOCO, Inc.

2.10 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. Use portland cement-lime, masonry cement or mortar cement mortar unless otherwise indicated.
 3. For exterior masonry, use portland cement-lime, masonry cement or mortar cement mortar.
 4. For reinforced masonry, use portland cement-lime, masonry cement or mortar cement mortar.
 5. 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, Proportion 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 M.

2. For reinforced masonry, use Type M.
3. For mortar parge coats, use Type S.
4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. 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 TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476,
3. Provide grout with a slump of 8 to 11 inches.

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 the Work.
 2. Verify that reinforcing dowels are properly placed.
 3. Verify that substrates are free of substances that impair mortar bond.
- 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 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. Mix units from several pallets or cubes as they are placed.

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.

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.
5. 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 running bond; 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 4 inches (100 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping 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. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- F. Build nonload-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 (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1219 mm) o.c. unless otherwise indicated.
 - 3. At fire-rated partitions, treat joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units and brick 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.

3.6 MASONRY-CELL FILL

- A. Vermiculite Insulation: ASTM C516, Type II
- B. Perlite Insulation: ASTM C549, Type IV.
- C. Pour loose-fill insulation into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 ft. (6 m).

3.7 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.

3.8 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.
- B. Form control joints in concrete masonry as follows:
 - 1. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.
- C. Provide horizontal, pressure-relieving joints by either leaving an airspace 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.

3.9 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 that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- 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 602/ACI 530.1/ASCE 6 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.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Contractor 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: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
 - 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.

3.11 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 nonmasonry 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 concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 7. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

END OF SECTION

SECTION 055000 - METAL FABRICATIONS

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. Steel framing and supports for mechanical and electrical equipment.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 3. Metal bollards.
 - 4. Loose bearing and leveling plates for applications where they are not specified in other Sections.

- B. Products furnished, but not installed, under this Section include the following:

- 1. Loose steel lintels.

- C. Related Requirements:

- 1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Fasteners.
 - 3. Shop primers.

4. Shrinkage-resisting grout.
 5. Metal bollards.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Steel framing and supports for mechanical and electrical equipment.
 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 3. Metal bollards.
 4. Loose steel lintels.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Research Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

- E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- G. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- H. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.
- I. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.
- J. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum or stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, (ASTM A563M, Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593 (ASTM F738M); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1).
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: 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 in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

2.3 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- G. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. 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. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.

- E. 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.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.6 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from 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.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.
- D. Prime miscellaneous steel trim with zinc-rich primer.

2.7 METAL BOLLARDS

- A. Fabricate metal bollards from shapes, as indicated.
- B. Fabricate bollards with baseplates for bolting to concrete slab. Drill baseplates at all four corners for anchor bolts as indicated.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Prime steel bollards with zinc-rich primer.

2.8 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize bearing and leveling plates.

2.9 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.10 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 - 4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.12 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. 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.
- B. 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.

- C. 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.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF 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.

3.3 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards to existing construction as indicated.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.4 INSTALLATION OF BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if

protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 072113- THERMAL INSULATION

PART 1 - GENERAL

1.1 STIPULATIONS

- 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. Board insulation at interior concrete as located on drawings.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this section.
- B. ASTM International (ASTM):
 - 1. ASTM C165 - [2012], Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
 - 2. ASTM C303 - [2010], Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
 - 3. ASTM C423 - [2009a], Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 4. ASTM C518 - [2015], Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 5. ASTM C612 - [2014], Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - 6. ASTM C665 - [2012], Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 7. ASTM C795 - [2013], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - 8. ASTM C1104/C1104M - [2013], Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
 - 9. ASTM C1338 - [2014], Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
 - 10. ASTM E96/E96M - [2016], Standard Test Methods for Water Vapor Transmission of Materials.

1.4 SUBMITTALS

- A. Submittal Drawings:
 - 1. Show insulation type, thickness, and R value for each location.
 - 2. Product Data: Submit product data including manufacturer's literature for insulation materials and accessories, indicating compliance with specified requirements and material characteristics.
 - 3. Submit list on insulation manufacturer's letterhead of materials and accessories to be incorporated into Work.

4. Submit MSDS - Material Safety Data Sheets for product.
5. Include product name.
6. Include preparation instructions and recommendations, installation methods, and storage and handling requirements.
7. Include contact information for manufacturer and their representative for this Project.

1.5 DELIVERY

- A. Deliver products in manufacturer's original sealed packaging.
- B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
- C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.
- D. Deliver materials and accessories in insulation manufacture's original packaging with identification labels intact and in sizes to suit project.
- E. Ensure insulation materials are not exposed to moisture during delivery.
- F. Replace wet or damaged insulation materials.

1.6 STORAGE AND HANDLING

- A. Store in original packaging until installed.
- B. Store products indoors in dry, weathertight facility.
- C. Protect products from damage during handling and construction operations.
- D. Protect foam plastic insulation from UV exposure.

1.7 WARRANTY

- A. 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.
- B. Warranty period: [1] years commencing on Date of Substantial Performance of Work

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer: ROCKWOOL, 8024 Esquesing Line, Milton, Ontario, L9T 6W3, Phone: 905-878-8474, Toll Free: 1-800-265-6878, e-mail: contactus@rockwool.com, URL: www.rockwool.com, or approved equal.

2.2 DESCRIPTION

- A. Non-combustible, rigid, water repellent, mineral wool insulation board for exterior non-structural commercial and industrial high performance insulation sheathing applications to ASTM C612, Type IVB

2.3 PERFORMANCE CRITERIA

- A. Board insulation for continuous insulation systems: To ASTM C612, Type IVB
- B. Fire Performance:

1. Non-combustibility: To CAN/ULC S114.
2. Surface Burning Characteristics:
 - a. Flame spread: 0.
 - b. Smoke developed: 0.
- C. Thermal Resistance (RSI value/25.4 mm at 24 ° C: [0.70] m2K/W to ASTM C518.
- D. Moisture resistance:
 1. Moisture sorption: 0.05 % maximum to ASTM C1104/C1104M.
 2. Water vapour transmission: 1768 ng/Pa·s·m2 to ASTM E96, Desiccant Method.
- E. Corrosive resistance:
 1. Steel to ASTM C665: Non-corrosive.
 2. Stainless steel to ASTM C795: Non-corrosive.
- F. Density: 128 kg/m3 to ASTM C303.
- G. Compressive strength: To ASTM C165.
 1. 21 kPa at 10 %.
 2. 50 kPa at 25 %.
- H. Recycled content: 16% minimum.
- I. Fungi resistance: To ASTM C1338.
- J. Acoustical performance sound absorption coefficients to ASTM C423.

2.4 MATERIALS

- A. Non-combustible, rigid, water repellent, mineral wool insulation board to ASTM C612, Type IVB
- B. Size: as indicated by manufacturer.
- C. Thickness: 3”.

2.5 ACCESSORIES

- A. Insulation Adhesive: Nonflammable type recommended by insulation manufacturer to suit application.
- B. Tape: Pressure sensitive adhesive on one face.
- C. Mechanical fasteners in accordance with insulation manufacturer's written recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Protect existing construction and completed work from damage.
- C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION - GENERAL

- A. Install products according to manufacturer's instructions and approved submittal drawings.
 1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
- B. Install board insulation with joints close and flush, in regular courses, and with end joints staggered.

- C. Fit insulation tight against adjoining construction and penetrations, unless indicated otherwise.

3.3 THERMAL INSULATION

A. Ceilings and Soffits:

- 1. Bond insulation to solid horizontal surfaces with adhesive. Tape joints with Manufacturers approved tape.

3.5 CLEANING

- A. Remove excess adhesive before adhesive sets.

3.6 PROTECTION

- A. Protect insulation from construction operations.
- B. Repair damage.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 STIPULATIONS

- 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 hollow-metal work.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
- E. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

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. Ceco Door; ASSA ABLOY.
 2. DKS Steel Door & Frame Systems, Inc.
 3. Republic Doors and Frames.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Hollow-Metal Doors and Frames: NAAMM-HMMA 860. At locations indicated in the Door and Frame Schedule.
 1. Physical Performance: Level A according to SDI A250.4.
 2. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.032 inch.
 - d. Edge Construction: Continuously welded with no visible seam.
 - e. Core: Steel stiffened.
3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch for frames that receive hollow-metal doors; minimum thickness of 0.042 inch for frames that receive hollow-core wood doors.
 - b. Materials: Uncoated steel sheet, minimum thickness of 0.042 inch, 0.053 inch.
 - c. Construction: Knocked down.
 4. Exposed Finish: Prime.

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.
 1. Physical Performance: Level B according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Knocked down.
 4. Exposed Finish: Prime.

2.4 FRAME ANCHORS

- A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Bituminous Coating: Cold-applied asphalt mastic, 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 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches. Provide beveled or square edges at manufacturer's discretion.
 - 4. Top Edge Closures: Close top edges of doors with flush, of same material as face sheets.
 - 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.

- 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Compression Type: Not less than two anchors in each frame.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 7. Terminated Stops: Terminate stops 6 inches above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 ACCESSORIES

- A. Louvers: If notes, provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.

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 embedded and built-in anchors to verify actual locations before frame installation.
- 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. Drill and tap doors and frames to receive nontemplated, 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 for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.

- e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
- 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
- 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- 7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
- 8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

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 Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 083200 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes access doors and frames for walls.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.2 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Fire-Rated, Flush Access Doors with Concealed Flanges:
 - 1. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for plaster installation, self-closing door, and concealed hinge.
 - 2. Locations: Wall
 - 3. Door Size: As indicated on Drawings.
 - 4. Fire-Resistance Rating: Not less than that of adjacent construction.
 - 5. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage, factory finished.
 - 6. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch (1.02 mm), 20 gage, factory finished.
 - 7. Latch and Lock: Self-closing, self-latching door hardware, prepared for mortise cylinder.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.

- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 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: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.
 - a. Color: As selected by Architect from full range of industry colors.

END OF SECTION

SECTION 087121 - DOOR HARDWARE
PART 1 - GENERAL

1.1 STIPULATIONS

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

1.2 GENERAL

A. Description Of Work

- 1. This specification covers the furnishing and installation of material for door hardware. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the products manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

- 1. This Section includes the following:
 - a. Cylinders for doors specified in other Sections.
- 2. Products furnished, but not installed, under this Section include the products listed below. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
 - a. Pivots, thresholds, weather stripping, and cylinders for locks specified in other Sections.
 - b. Permanent cores to be installed by the Owner.

C. Action Submittals

- 1. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- 2. Samples for Initial Selection: For plastic protective trim units in each finish, color, and texture required for each type of trim unit indicated.
- 3. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.
 - a. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.
 - 1) Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- 4. Other Action Submittals:
 - a. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

Submittal Sequence: Submit door hardware schedule after or

concurrent with submissions of Product Data, Samples, and Shop Drawings, as directed. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

- 1) Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
- 2) Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
- 3) Content: Include the following information:
 - a) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d) Fastenings and other pertinent information.
 - e) Explanation of abbreviations, symbols, and codes contained in schedule.
 - f) Mounting locations for door hardware.
 - g) List of related door devices specified in other Sections for each door and frame.
- b. Keying Schedule: Prepared by or under the supervision of Installer, detailing the Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

D. Informational Submittals

1. Qualification Data: For Installer and Architectural Hardware Consultant.
2. Product Certificates: For electrified door hardware, from the manufacturer.
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
3. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
4. Warranty: Special warranty specified in this Section.

E. Closeout Submittals

1. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

F. Quality Assurance

1. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
 - a. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and the Owner about door hardware and keying
2. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material,

- design, and extent to that indicated for this Project.
3. Source Limitations: Obtain each type of door hardware from a single manufacturer.
 - a. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
 4. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
 5. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.
 - a. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
 - b. Comply with the following maximum opening-force requirements:
 - 1) Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
 - c. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high and 3/4 inch (19 mm) high for exterior sliding doors.
 - d. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
- G. Delivery, Storage, And Handling
1. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
 2. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
 3. Deliver keys to manufacturer of key control system for subsequent delivery to the Owner.
 4. Deliver keys and permanent cores to the Owner by registered mail or overnight package service.
- H. Coordination
1. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
 2. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
 3. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.
- I. Warranty
1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Structural failures including excessive deflection, cracking, or breakage.
 - 2) Faulty operation of doors and door hardware.

- 3) Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - b. Warranty Period: Three years from date of Final Completion, except as follows:
 - 1) Exit Devices: Two years from date of Final Completion.
 - 2) Manual Closers: 10 years from date of Final Completion.
- J. Maintenance Service
 1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
 2. Maintenance Service: Beginning at Final Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

- A. Scheduled Door Hardware
 1. General: Provide door hardware for each door indicated in Part 1.3 "Door Hardware Sets" Article to comply with requirements in this Section.
 - a. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.
 - b. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 2. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 1.3 "Door Hardware Sets" Article. Products are identified by descriptive titles corresponding to requirements specified in Part 1.2.
- B. Hinges
 1. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 2. Antifriction-Bearing Hinges:
 - a. Mounting: Full-Mortise (Butt).
 - b. Bearing Material: Manufacturer's standard antifriction bearing/
 - c. Grade: Grade 1 (heavy weight).
 - d. Base and Pin Metal:
 - 1) Interior Hinges: Brass with stainless-steel pin body and brass protruding heads OR
Steel with steel pin OR Stainless steel with stainless-steel pin, as directed.
 - e. Pins: Maximum.
 - f. Tips: Flat button.
 - g. Corners: Square.
 3. Plain-Bearing Hinges: Grade 3 (standard weight).
 - a. Mounting: Full mortise (butts) OR Half mortise OR Full surface OR Half surface, as directed.
 - b. Base and Pin Metal: Brass with stainless-steel pin body and brass protruding heads OR

- Steel with steel pin, as directed.
 - c. Pins: Non-rising loose unless otherwise indicated OR Maximum security OR Nonremovable, as directed.
 - 1) Outswinging Corridor Doors with Locks: Maximum security OR Nonremovable, as directed.
 - d. Tips: Flat button OR Hospital OR Oval OR Ball OR Steeple OR Urn OR Acorn, as directed.
 - e. Corners: Square OR 5/32-inch (4-mm) radius OR 1/4-inch (6-mm) radius OR 5/8-inch (16-mm) radius, as directed.
 - f. Options: Raised barrel, as directed.
 - 4. Anchor Hinge Set: Grade 1 (heavy weight); consisting of one anchor hinge plus two full-mortise hinges; antifriction bearing; handed; nonremovable pins; flat-button tips.
 - a. Base Metal: Wrought brass or bronze OR Stainless steel OR Wrought, forged, or cast steel, or malleable iron, as directed.
 - b. Electric Option for Center Hinge: Concealed electric through wires OR Concealed electric switch, as directed.
 - 5. Pocket Hinges: Antifriction bearing; Grade 1 (heavy weight); jamb leaf visible when door is closed and both leaves concealed when door is in pocket; type required for application indicated; cast steel.
 - 6. Double-Acting Pivot-Hinge Set: Grade 2; wrought, forged, or cast steel or malleable iron base metal; consisting of a top pivot and a bottom pivot, each with jamb brackets, and bottom pivot with thrust steel bearing.
- C. Keying
- 1. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
 - a. No Master Key System: Only change keys operate cylinder.
 - b. Master Key System: Change keys and a master key operate cylinders.
 - 2. Keys: Nickel silver.
 - a. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - 1) Notation: "DO NOT DUPLICATE."
 - b. Quantity: In addition to one extra key blank for each lock, provide the following:
 - 1) Cylinder Change Keys: As directed by Owner (5-6).
- D. Operating Trim
- 1. Operating Trim: BHMA A156.6; aluminum OR brass OR bronze OR stainless steel, as directed, unless otherwise indicated.
 - 2. Flat Push Plates: 0.050 inch (1.3 mm) OR 1/8 inch (3.2 mm) thick, as directed, 4 inches wide by 16 inches high (102 mm wide by 406 mm high), with square corners and beveled edges; secured with exposed screws.
 - 3. Push-Pull Plates: 1/8 inch (3.2 mm) thick, 3-1/2 inches wide by 15-3/4 inches high (89 mm wide by 400 mm high), with square corners, beveled edges, and raised integral lip; secured with exposed screws.
 - 4. Straight Door Pulls: With minimum clearance of 1-1/2 inches (38 mm) from face of door.
 - a. Type: 3/4-inch (19-mm) constant-diameter OR variable-diameter OR flattened-round OR hospital-type pull, as directed.
 - b. Mounting: Surface applied with concealed fasteners OR Through bolted with oval-head machine screws and countersunk washers OR Back to back with

- threaded sleeves, as directed.
 - c. Overall Length: 9 inches (229 mm), as directed.
 - 5. Offset Door Pulls: 1-inch (25-mm) constant-diameter pull with minimum clearance of 2-1/4 inches (57 mm) from face of door and offset of 2 inches (51 mm).
 - a. Mounting: Surface applied with concealed fasteners OR Through bolted with oval-head machine screws and countersunk washers OR Back to back with threaded sleeves, as directed.
 - b. Overall Length: 9 inches (229 mm).
 - 6. Flush Door Pulls: Mortised 1/2 inch (13 mm) deep; secured with screws.
 - a. Shape: Rectangular with rectangular recess.
 - b. Size: 3-1/2 inches wide by 4-3/4 inches high (89 mm wide by 121 mm high).
 - 7. Straight Pull-Plate Door Pulls: 0.050-inch- (1.3-mm-) thick plate, 4 inches wide by 16 inches high (102 mm wide by 406 mm high) with square corners and beveled edges; pull with minimum clearance of 1-1/2 inches (38 mm) from face of door.
 - a. Type: 3/4-inch (19-mm) constant-diameter OR variable-diameter OR flattened-round OR hospital-type pull, as directed.
 - b. Mounting: Surface applied with concealed fasteners OR Through bolted with oval-head machine screws and countersunk washers OR Back to back with threaded sleeves, as directed.
 - c. Overall Pull Length: 9 inches (229 mm).
 - 8. Offset Push-Pull Door Pulls: 0.050-inch- (1.3-mm-) thick plate, 4 inches wide by 16 inches high (102 mm wide by 406 mm high) with square corners and beveled edges; 1-inch (25-mm) constant-diameter pull with minimum clearance of 2-1/4 inches (57 mm) from face of door and offset of 2 inches (51 mm).
 - a. Overall Pull Length: 9 inches (229 mm).
 - 9. Single Push Bar: Horizontal bar, with minimum clearance of 1-1/2 inches (38 mm) from face of door.
 - a. Shape and Size: 1-inch (25-mm) constant-diameter round bar OR Minimum 3/8-by-1-1/4-inch (10-by-32-mm) flat bar, as directed.
 - b. Mounting: Surface applied with concealed fasteners OR Through bolted with oval-head machine screws and countersunk washers, as directed.
 - 10. Double Pull Bar: Two horizontal bars connected by matching vertical pull bar and spaced at 8 inches (200 mm) o.c.; with minimum clearance of 1-1/2 inches (38 mm) from face of door.
 - a. Shape and Size: 1-inch (25-mm) constant-diameter round bars OR Minimum 3/8-by- 1- 1/4-inch (10-by-32-mm) flat bars, as directed.
 - b. Mounting: Surface applied with concealed fasteners OR Through bolted with oval-head machine screws and countersunk washers, as directed.
- E. Surface Closers
- 1. Surface Closer with Cover: Grade 1 OR 2 Modern Type, as directed; with mechanism enclosed in cover.
 - a. Mounting: Hinge side OR Opposite hinge side OR Parallel arm OR Bracket OR Hinge side, top jamb OR Opposite side, top jamb, as directed.
 - b. Type: Regular arm OR Hold open OR Fusible-link holder arm OR Slide track arm OR Dead stop OR Dead stop hold open OR Delayed action closing, as directed.
 - c. Backcheck: Factory preset OR Adjustable, as directed, effective between 60 and 85 degrees of door opening.

- d. Cover Material: Aluminum OR Plated steel OR Molded plastic, as directed.
- e. Closing Power Adjustment: At least 50 OR 35 OR 15 percent more than minimum tested value, as directed.

F. Door Gasketing

- 1. Door Sweeps: Neoprene OR Vinyl OR Nylon brush OR Polyurethane OR Silicone gasket material, as directed held in place by flat aluminum OR bronze, as directed housing or flange; surface mounted to face of door with screws.

G. Auxiliary Door Hardware

- 1. Wide-Angle Door Viewers: Grade 1 OR 2 OR 3, as directed; solid brass with optical glass lenses; adjustable to door thickness and permitting 1-way observation with minimum 190-degree viewing angle.

H. FABRICATION

- 1. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by the Owner.
 - a. Manufacturer's identification is permitted on rim of lock cylinders only.
- 2. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- 3. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - a. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

I. FINISHES

- 1. Provide finishes complying with BHMA A156.18.
- 2. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 3. 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

A. Examination

- 1. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

2. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Preparation
1. Steel Doors and Frames: For Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI/SDI A250.6.
- C. Installation
1. Mounting Heights: Mount door hardware units at heights indicated on Drawings as follows, unless otherwise indicated or required to comply with governing regulations.
 - a. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - b. Custom Steel Doors and Frames: HMMA 831.
 - c. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 2. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided. per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
 3. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - a. Replace construction cores with permanent cores as directed by the Owner.
 - b. Furnish permanent cores to the Owner for installation.
 4. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- D. Adjusting
1. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
- E. Cleaning And Protection
1. Clean adjacent surfaces soiled by door hardware installation.
 2. Clean operating items as necessary to restore proper function and finish.
 3. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Final Completion.

END OF SECTION

SECTION 092813 - GYPSUM BOARD

PART 1 - GENERAL

1.1 STIPULATIONS

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

1.2 GENERAL

A. Description Of Work

- 1. This specification covers the furnishing and installation of materials for gypsum board. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

- 1. This Section includes the following:
 - a. Interior gypsum board.

C. Submittals

- 1. Product Data: For each type of product indicated.
- 2. Samples: For the following products:
 - a. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
 - b. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

D. Storage And Handling

- 1. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

E. Project Conditions

- 1. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- 2. Do not install interior products until installation areas are enclosed and conditioned.
- 3. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Panels, General

1. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
 2. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. Interior Gypsum Board
1. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
 2. Regular Type:
 - a. Thickness: 1/2 inch (12.7 mm).
 - b. Long Edges: Tapered
 3. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
 - a. Thickness: 1/2 inch (12.7 mm).
 - b. Long Edges: Tapered.
- C. Trim Accessories
1. Interior Trim: ASTM C 1047.
 - a. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet
 - b. Shapes:
 - 1) Cornerbead.
- D. Joint Treatment Materials
1. General: Comply with ASTM C 475/C 475M.
 2. Joint Tape:
 - a. Interior Gypsum Wallboard: Paper.
 3. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - a. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping.
 - 1) Use setting-type compound for installing paper-faced metal trim accessories.
 - c. Fill Coat: For second coat, use setting-type, sandable topping.
 - d. Finish Coat: For third coat, use setting-type, sandable topping.
- E. Auxiliary Materials
1. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
 2. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - a. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - b. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
 3. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation".
 4. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation".

PART 3 - EXECUTION

A. Examination

1. Examine areas and substrates, with Installer present, and including welded hollow-metal frames

- and framing, for compliance with requirements and other conditions affecting performance.
2. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Applying And Finishing Panels, General

1. Comply with ASTM C 840.
2. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
3. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
4. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
5. Form control and expansion joints with space between edges of adjoining gypsum panels.
6. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - b. Fit gypsum panels around ducts, pipes, and conduits.
 - c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
7. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
8. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

C. Applying Interior Gypsum Board

1. Install interior gypsum board in the following locations:
 - a. Regular Type: As indicated on Drawings.
 - b. Ceiling Type: As indicated on Drawings OR Ceiling surfaces, as directed.
2. Single-Layer Application:
 - a. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - b. On partitions/walls, apply gypsum panels vertically (parallel to framing) OR horizontally (perpendicular to framing), as directed, unless otherwise indicated or required by fire- resistance-rated assembly, and minimize end joints.
 - 1) Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 2) At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - c. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - d. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

D. Installing Trim Accessories

1. 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.

2. Interior Trim: Install in the following locations:
 - a. Cornerbead: Use at outside corners, unless otherwise indicated.

E. Finishing Gypsum Board

1. 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.
2. Prefill open joints, rounded or beveled edges, and damaged surface areas.
3. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
4. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - a. Level 3: For surfaces receiving medium- or heavy-textured finishes before painting or heavy wallcoverings where lighting conditions are not critical OR Where indicated on Drawings.

F. Protection

1. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
2. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 099123- INTERIOR PAINTING

PART 1 - GENERAL

1.1 STIPULATIONS

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

1.2 GENERAL

A. Description Of Work

- 1. This specification covers the furnishing and installation of materials for interior painting. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

- 1. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - a. Gypsum board.
 - b. Concrete Masonry Units

C. Submittals

- 1. Product Data: For each type of product indicated.
- 2. Samples: For each finish and for each color and texture required.
- 3. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 1.2, with the proposed product highlighted.

D. Quality Assurance

- 1. MPI Standards:
 - a. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - b. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

E. Delivery, Storage, And Handling

- 1. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - a. Maintain containers in clean condition, free of foreign materials and residue.
 - b. Remove rags and waste from storage areas daily.

F. Project Conditions

- 1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- 2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

A. Paint, General

1. Material Compatibility:
 - a. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - b. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
2. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - b. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - c. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - d. Floor Coatings: VOC not more than 100 g/L.
 - e. Shellacs, Clear: VOC not more than 730 g/L.
 - f. Shellacs, Pigmented: VOC not more than 550 g/L.
 - g. Flat Topcoat Paints: VOC content of not more than 50 g/L.
 - h. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 - i. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - j. Floor Coatings: VOC not more than 100 g/L.
 - k. Shellacs, Clear: VOC not more than 730 g/L.
 - l. Shellacs, Pigmented: VOC not more than 550 g/L.
 - m. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - n. Dry-Fog Coatings: VOC content of not more than 400 g/L.
 - o. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
 - p. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
3. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - a. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - b. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.

- 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.
 - 23) Toluene (methylbenzene).
 - 24) 1,1,1-trichloroethane.
 - 25) Vinyl chloride.
4. Colors: As selected from manufacturer's full range.
- B. Block Fillers
1. Interior/Exterior Latex Block Filler: MPI #4.
 - a. VOC Content: E Range of E2.
- C. Primers/Sealers
1. Interior Latex Primer/Sealer: MPI #50.
 - a. VOC Content: E Range of E1.
 - b. Environmental Performance Rating: EPR 1.
 2. Interior Alkyd Primer/Sealer: MPI #45.
 - a. VOC Content: E Range of E1.
- D. Latex Paints
1. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).
 - a. VOC Content: E Range of E3.
 - b. Environmental Performance Rating: EPR 4.5.

PART 3 - EXECUTION

- A. Preparation
1. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
 2. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - b. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 3. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - a. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
 4. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

B. Application

1. Apply paints according to manufacturer's written instructions.
 - a. Use applicators and techniques suited for paint and substrate indicated.
 - b. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - c. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
2. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
3. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
4. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

C. Field Quality Control

1. Testing of Paint Materials: the Owner reserves the right to invoke the following procedure at any time and as often as the Owner deems necessary during the period when paints are being applied:
 - a. the Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 - b. Testing agency will perform tests for compliance with product requirements.
 - c. the Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

D. Cleaning And Protection

1. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
2. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
3. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by the Owner, and leave in an undamaged condition.
4. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

E. Interior Painting Schedule

1. Gypsum Board and Concrete Masonry Unit Substrates:
 - a. Latex System: MPI INT 9.2A.
 - 1) Prime Coat: Interior latex primer/sealer (for MPI Premium Grade system)
 - 2) Intermediate Coat (for MPI Premium Grade system): Interior latex matching topcoat.
 - 3) Topcoat

SECTION 210010 - GENERAL REQUIREMENTS FIRE PROTECTION

PART 1 - GENERAL REQUIREMENTS FIRE PROTECTION

1.1 GENERAL

- A. The conditions of Divisions 00 and 01 apply to each and every Trade Contractor or other person or persons supplying any material or labor entering this building and/or site, either directly or indirectly. In the event of a conflict between Section 210010 and Divisions 00 and 01, the terms of Divisions 00 and 01 shall govern.
- B. The Fire Protection Work will be performed as a Sub-Contract to the Plumbing Prime Contractor.
- C. One Building Trade, the Fire Protection Building Trade, will be covered by these General Requirements Fire Protection.
- D. For simplicity, this Building Trade will be referred to further herein as the Fire Protection Trade Contractor. The Fire Protection Specifications and all Fire Protection Drawings, together with all addenda make-up the Fire Protection Contract Documents, and are a part of the "Project Contract Documents", as described throughout these specifications.
- E. The term "Electrical Trade" as used in the Contract Documents, means the Electrical Building Trade.
- F. The term "indicated" means all information included, detailed, shown and/or implied on the Contract Documents.
- G. The term "existing" is used generally in reference to renovation projects. On new construction projects, the term "existing" is intended to mean work already in place.

1.2 INTENT OF THE FIRE PROTECTION CONTRACT DOCUMENTS

- A. The intent of the Fire Protection Contract Documents is to include all items and labor necessary for the proper execution and completion of the Work of the Fire Protection Trade Contractor. The Contract Documents of all Trades are complimentary to each other; what is required by one shall be as binding as if required by all. Performance of the Fire Protection Trade Contractor is required only to the extent consistent with the Project Contract Documents and reasonably inferable from them as being necessary to produce the desired results.
- B. It is expressly stipulated that neither the Drawings nor the Specifications shall take precedence over the other, and it is further stipulated that the Architect/Engineer may interpret or construe the Drawings and Specifications so as to secure in all cases the result most consistent with the needs and requirements of the work. In the event of such ambiguity or discrepancy, comply with the higher cost product (material plus labor), the more stringent requirement, and supply the better quality or greater quantity of work.

1.3 PROPOSAL PREPARATION

A. Prior to submitting a pricing quotation/proposal, proceed as follows, and include the following:

1. Visit the site, survey, record, confirm and include in the scope of work, all material and labor necessary to install the equipment and systems indicated. Use the Contract Documents as diagrammatic in nature, since they are not intended to show all details which may affect the fire protection bid proposal.
2. Include the work, as applicable, to remove and dispose of sprinklers, piping, equipment and appurtenances, not required for new work, unless otherwise indicated to be abandoned in place.
3. Include all disconnections, removals and temporary provisions required to permit rigging, installation, connection, testing and operation of the new equipment. Include all such provisions whether or not shown, detailed or specified within technical sections of the Contract Documents.
4. Include in the work, providing the labor of Keymen, including, but not limited to the following:
 - a. One Project Manager;
 - b. One Project Foreman.
5. Foreman must refine the detail, layout, coordination and fit of all of the fire protection equipment. Plan all disconnections, removals, offsets, temporary provisions, as required, to fit the new equipment into the space, and as required to accommodate maintenance accessibility and service access.
6. Project Manager must maintain and submit for approval, a written project schedule, on a weekly basis.
7. All Project Managers must organize, administrate, control and log the RFI process for their respective trade. Where applicable, submit all RFI(s) for master RFI log maintained by Lead/Prime Contractor.

B. In preparing a Bid Price:

1. Thoroughly review and confirm all existing conditions and Contract Document information. Make note in writing of any exceptions, misunderstandings, unclear areas, unclear directions, and any aspects which will prohibit completion of the work, in total. Failing to supply such notice, all bidders will be accountable for having accepted all conditions at the site which affect their work and their costs. By submitting a bid price, all Trade Contractors certify that the Contract Documents have been thoroughly reviewed and are sufficient for construction, and that the bidding Trade Contractors have adequate information to establish and determine their responsibility for materials, methods, costs, and schedule for their work.
2. Incorporate all requirements of all sections of the Contract Documents.
3. Include the following with the Manufacturer's and Sub-Contractor's Lists:
 - a. The name and telephone number of all Sub-Contractors.

1.4 HAZARDOUS MATERIALS

- A. The use of asbestos, PCB's or any material or product containing hazardous materials in the performance of this contract is not permitted. Certify, in writing, that no hazardous material or product containing a hazardous material, has been furnished or installed.

1.5 DRAWINGS AND SPECIFICATIONS

- A. It is the intent of the specifications and drawings to include under each item all materials, apparatus and labor 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 properly operating whole.
- B. Any apparatus, machinery, small items not mentioned in detail which are necessary to complete or perfect any portion of the installation in a substantial manner and in compliance with the requirements stated, implied or intended must be furnished and/or installed without extra cost to the Project. This includes all materials, devices or methods peculiar to the machinery, apparatus or systems furnished and/or installed by the Fire Protection Trade Contractor.
- C. In referring to drawings, figured dimensions take precedence over scale measurements. Verify all wall locations, ceiling heights, elevations, dimensions, etc. on the architectural drawings, where applicable. Discrepancies must be referred to the Engineer for decision. Certify and verify all dimensions, routings and layouts in the field and on the coordination drawings before ordering material or commencing work.
- D. Any work called for in the specifications, but not mentioned or shown on the drawings, or called for on the drawings, but not mentioned in the specifications, must be furnished and/or installed as though called for in both.
- E. When any device or part of equipment is herein referred to in the singular number, such as "the pump" such reference is deemed to apply to as many such devices as required to complete the installation.
- F. The term "Provide" means "Furnish and Install". Neither term will be used generally in these specifications, but will be assumed. The term "Furnish" means to obtain and deliver to the job site for installation by other trades.

1.6 LAWS, ORDINANCES, REGULATIONS AND PERMITS

- A. The entire fire protection system in all and/or in part must conform to all pertinent laws, ordinances and regulations of all bodies having jurisdiction, notwithstanding anything in these drawings or specifications to the contrary.
- B. Pay all fees and obtain and pay for all permits and inspections required by any authority having jurisdiction in connection with the work under this contract.
- C. Electrical work performed by the Fire Protection Trade Contractor must comply with the requirements of the National Electrical Code, NFPA and other boards and departments having local jurisdiction.

1.7 CONNECTIONS TO UTILITIES

- A. Apply for and obtain services from Utility Companies and municipalities. All charges for which Utility Companies and municipalities must be reimbursed must be paid for by the Fire Protection Trade Contractor at no additional cost to the Project.

1.8 TESTS

- A. The following requirements are supplementary to tests specified for individual equipment or systems in other specification sections. Give written notice of date of test in ample time to all concerned.
- B. Concealed or insulated work must remain uncovered until all required tests have been completed; but if construction schedule requires, arrange for partial tests on portions of systems as approved. If a Prime Contractor covers or directs a Sub-Contractor to cover fire protection work prior to completing the required tests, the Prime Contractor is responsible for any additional costs related to completing the required tests.
- C. As soon as conditions permit, conduct preliminary tests of equipment to ascertain compliance with specified requirements. Make needed changes, adjustments and/or replacements as preliminary tests may indicate, prior to acceptance tests.
- D. Conduct pressure, performance and operating tests as specified or required for each system or piece of equipment installed, modified or affected under this contract in presence of the Engineer or Owner as well as a representative of agencies having jurisdiction.
- E. Obtain Certificates of Approval and/or Acceptance as specified or required in compliance with regulations of agencies having jurisdiction. Work will not be deemed complete until such Certificates have been delivered to the Engineer.
- F. Prove conclusively, by testing, that fire protection systems operate properly, efficiently and quietly in accordance with intent of drawings, specifications and most widely used construction practice.

1.9 CLEANING

- A. Be responsible for the following:
 - 1. Removal of all lumber, refuse, metal, piping and debris from site resulting from fire protection work.
 - 2. Cleaning drippings created by the fire protection work, from finished work of other Trades.
 - 3. Cleaning, polishing, waxing of fire protection work as required.
- B. After testing, and acceptance of all work by the Engineer and the Owner, thoroughly clean all fire protection equipment and material to the satisfaction of the Engineer.

1.10 GUARANTEE

- A. All material, equipment and workmanship must be in first class operating condition in every respect at time of acceptance by Owner. Acceptance by the Owner will be by letter written to the Fire Protection Trade Contractor.
- B. Unconditionally guarantee in writing all materials, equipment and workmanship for a period of one (1) year from date of acceptance by Owner. During the guarantee period, repair or replace, at the Fire Protection Trade Contractor's expense, any materials, equipment or workmanship in which defects may develop and provide free service for all equipment and systems involved in the contract during this guarantee period. Beneficial use of any system by the any of the Trade Contractors during construction does not constitute acceptance by the Owner. Time period of this beneficial use cannot be included in the guarantee period.
- C. Guarantee must also include restoration to its original condition of all adjacent work that is disturbed in fulfilling this guarantee.
- D. All such repairs and/or replacements must be made without delay and at the convenience of the Owner.
- E. Guarantees furnished by Trade Contractors and/or equipment manufacturers must be counter-signed by the related Trade Contractor for joint and/or individual responsibility for subject item.
- F. Manufacturers' equipment guarantees or warranties extending beyond the guarantee period described in item B above must be transferred to the Owner along with the Trade Contractor's guarantees.

1.11 ENTRANCE OF EQUIPMENT

- A. Determine the method of equipment entrance during initial site visit prior to bidding. Do not scale building openings, door widths, equipment or component sizes off the drawings. Determine sizes from site measurements and the equipment manufacturer. Include cost of equipment manufacturer's knockdown, use of field assembled equipment, field assembly, all work required for access, removals, replacements, general construction, and the like, as required. During preparation of submittals, verify whether knocked-down or pre-disassembled equipment have been proposed all to the extent required to permit entry of equipment to final location. Verify that the use of field assembled (not pre-assembled) equipment complies with manufacturer's warranty, guarantee, listings and requirements.
- B. Perform all necessary rigging required for completion of fire protection work.
- C. Deliver products to the site properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification. Deliver products and equipment to the site properly weatherproofed.
- D. The Trade Contractor who furnishes or purchases the product or equipment is responsible to provide and maintain protection from the weather, dust, dirt, construction debris, etc. until the project is complete.

- E. For all products and equipment which, when installed, have an opening into the building must be provided with a plywood cover, or similar protection, to prevent debris, rain, etc. from entering the building. The Trade Contractor who installs the product or equipment is responsible for such protection beginning at the time of installation.

1.12 SERVICING OF EQUIPMENT AND SYSTEMS

- A. After work has been completed in accordance with the Contract Documents, and prior to final acceptance tests, each Trade Contractor must have manufacturers or their authorized agents of the equipment installed, completely check their equipment and put equipment into proper operation. In each case, the respective Trade Contractor must have the manufacturers thoroughly check the complete installation of the equipment, furnished by the manufacturer, for proper and correct operation under the service intended.
- B. Six months after final acceptance of the work under the Contract Documents, each of the Trade Contractors must have the manufacturers again check their equipment for proper operation and lubrication. Coincidentally, these Trade Contractors must assure that the Owner is properly instructed in the servicing of the equipment.
- C. Prior to expiration of the guarantee period, each Trade Contractor must check all equipment, materials and systems for which he is responsible, make necessary adjustments and/or replacements, and leave systems in first class operating condition.

1.13 EXCAVATION AND BACKFILLING

- A. Perform all excavation, backfilling and pumping necessary for completion of fire protection work. All excavation is considered classified.
- B. Remove from premises or deposit as directed by Engineer all material excavated and not required or suitable for backfilling.
- C. Carefully remove and store topsoil, shrubbery and sod until underground work is complete and trenches are backfilled and then re-install. Replace any damaged items to the satisfaction of the Engineer.
- D. Allow adequate cover over piping and conduit in trenches as applicable. Trench walls must be perpendicular to the top of piping and conduits and trench bottoms must be instrument graded in the direction of flow as required. Earth must be scooped out under pipe hubs to provide a solid bearing for the pipe or conduit on undisturbed earth. Cinder fill, stones or bricks beneath piping are prohibited. Pipes and conduits less than 6-inches in outside diameter which do not require sloping, shall have hard trench bottoms and shall be supported on undisturbed subgrade. Trench bottoms for sloping utilities, pipes and conduits over 6-inches in outside diameter shall be excavated 6-inches deeper than elevation and a 6-inch thick tamped bedding shall be installed. Bedding shall be naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- E. Provide sheathing, shoring and bracing necessary to complete excavation and backfilling work and exercise every precaution necessary to prevent accident, injury or death to any human and

damage to property of others. Remove all debris, sheathing, shoring and bracing upon completion of work.

- F. It is the responsibility of each Trade Contractor to check with the various Utility Companies and make the necessary arrangements to avoid damage to their property. Each Trade Contractor is responsible for damage during excavation to existing underground structures including, but not limited to electric, structural, piping or equipment. Such damage must be repaired promptly without cost to the Project. Do not dig until all underground utilities are identified and located.
- G. Backfill after inspection and approval. Backfill must be made with clean earth, free from rocks, frozen particles, debris or other foreign materials. Deposit in uniform layers not over six inches (6") thick with each layer mechanically tamped before the next layer is applied. When approved backfill material is not available from the site, each Trade Contractor, at no additional cost to the project, must provide additional select backfill to complete installation. Partial backfill on piping leaving all joints exposed is mandatory for all underground gas and underground domestic water systems. Final backfill only after testing procedures have been approved.
- H. All trenches that pass under wall foundations must be backfilled with lean concrete, full height, directly under wall footing, and at a 1:1 slope away from wall or column footing. Trenches that are parallel with and deeper than wall foundations must be backfilled with lean concrete on a 1:1 slope away from the bottom of the wall or column footing.
- I. Perform all cutting and patching to driveways, sidewalks, curbs, bituminous paving, walls, and the like, required by performance of excavation and backfilling. Install and maintain temporary paving as directed by Engineer. Make repairs to sidewalks in complete blocks, partial patching will not be acceptable. Provide all materials for patching in strict accordance with applicable Articles of Divisions 01 through 33 of the Contract Specifications. All patching to match adjacent construction.
- J. Where rock is encountered during installation of underground piping systems, carry trenches to a point six inches (6") below invert of pipe and provide a six inch (6") layer of crushed stone or gravel as a cushion.
- K. All excavation work must include all pumping equipment, materials and labor necessary to keep all excavations free of water. Provide well points as required with disposition of water as directed by Architect/Engineer.
- L. Provide suitable indemnity for all accidents to humans, animals or equipment caused by excavating and backfilling work. Provide suitable guards, barricades, red lanterns, flares and take the necessary precaution for an approved and safe installation. All trenches must be backfilled at the end of each working day. Where a trench must be left open, provide coverings of adequate size and strength over entire open area.
- M. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6-inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
 - 1. Red: Electric.

2. Blue: Water systems.

- N. Trade Contractors shall engage the services of a Utility Identification Sub-Contractor to identify all existing underground utilities in the path of the proposed trench excavation. It shall be the Utility Identification Sub-Contractor's sole responsibility to search, investigate, test and identify existing underground utilities such as, but not limited to the following: gas piping, water piping, steam piping, condensate piping, electrical lines, sanitary piping, storm water piping, data, telephone, fiber optics and any other utility service, piping, lines or trenches. Before excavation can begin, the Trade Contractors shall provide all utility data concerning the underground utilities to Design Professional, and Owner. Data shall be in the form of a scaled drawing of the proposed excavation with all utilities clearly indicated.

1.14 CONTINUITY OF SERVICES

- A. Generally, no actions can be taken by the Fire Protection Trade Contractor that will interrupt any of the existing building services for these buildings or any other building until previously arranged and scheduled with the Engineer and Owner.
- B. Should any service be interrupted by the Fire Protection Trade Contractor, immediately provide all labor, including overtime if necessary, and all material and equipment necessary for restoration of such service, at no additional cost to the Project.

1.15 SMOKE AND FIRESTOPPING (GENERAL)

- A. Furnish and install a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and to maintain the integrity of the "fire and/or smoke" rated construction. Refer to Division 07 of these specifications. Fire and smoke rated construction is identified on the Architectural Drawings. Provide firestopping in the following locations:
1. Pipe and conduit penetrations through above grade floor slabs and through "fire and/or smoke"-rated partitions and fire walls.
 2. Penetrations of vertical shafts including, but not limited to pipe chases, duct chases, elevator shafts, and utility chutes.
 3. Other locations where indicated or required.
- B. Prepare submittals and submit for approval. Include manufacturer's descriptive data, typical details, installation instructions and the fire/smoke test data and/or report as appropriate for the time rated construction and location. The fire/smoke test data must include a certification by a nationally recognized testing authority that the material has been tested in accordance with ASTM E 814, or UL 1479 fire tests.
- C. Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, and protect from damage and exposure to elements. Damaged, deteriorated or outdated shelf life materials shall not be used and must be removed from the site.

1.16 COORDINATION DRAWINGS

- A. The Plumbing Contractor shall initiate coordination drawings. The Fire Protection Contractor must coordinate fire protection work with the Plumbing Contractor. Coordination drawings shall detail major elements, components, and systems of equipment and materials in relationship with other systems, installations, and building components. Use proposed equipment submittals, which include certified dimensions, service clearances, etc., to prepare the coordination drawings. If equipment is submitted for review after completion of the coordination drawings and rejected during the submittal review process, because the equipment fails to meet the project specifications, the Contractor is responsible to coordinate revision to the coordination drawings and layout the work using equipment which meets the project specifications.
1. Indicate the proposed locations of ductwork, equipment, and materials. Include the following:
 - a. Clearances for installing and maintaining insulation.
 - b. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - c. Equipment connections and support details.
 - d. Exterior wall and foundation penetrations.
 - e. Fire-rated wall and floor penetrations.
 - f. Location of structural columns, beams and supports.
 2. The foregoing information and coordination work must be provided by the applicable Trade Contractor using the coordination drawings as initiated by the Plumbing Contractor.

1.17 TRADE CONTRACTOR'S CERTIFICATION

- A. Upon final completion of all work, each Trade Contractor must provide a notarized letter on Corporate letterhead, executed by a Corporate Officer, or Company Partner, stating that the work has been completed in accordance with the Contract Documents, Addenda, Bulletins, Trade Contractor's Punch List items and Architect's/Engineer's Construction Observation Report(s). Final Payment will not be approved until the notarized letter has been provided. Refer to the following sample letter.

SAMPLE LETTER

ENGINEER/ARCHITECT _____

TRADE CONTRACTOR _____

PROJECT _____ NO. _____

I hereby certify that all work under the HVAC, Plumbing, Fire Protection and Electrical Contract Documents, as applicable, including all addenda, bulletins, Punch List items and Construction Observation Reports, has been completed and the quality and workmanship of the work has been performed in accordance with Contract Documents.

State of: _____

County of: _____

Trade Contractor: _____

Subscribed and Sworn to before
me this _____ day of
20 _____

Notary Public: _____

By: _____

Date: _____

My Commission Expires: _____

(Ctrl) +

1.18 CONNECTIONS TO EXISTING SYSTEMS

- A. Work under this contract may require connections to existing fire protection systems. Include in the bid, all material and labor necessary to perform the following work:
1. Drain the system to level necessary to complete the work;
 2. Fill the system to original fill pressure while venting excess air from the system.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S AND SUB-CONTRACTORS LIST, KEYMEN RESUMES

- A. Before ordering any material or equipment unit, and not later than ten (10) working days after signing of contracts, submit a list of Manufacturers, Sub-Contractors and Suppliers showing make, type, manufacturer's name and trade designation of all materials, and equipment, proposed for use under this contract. Prepare list by reference to specifications. Identify all long lead submittals which will require and expedited submittal review.

- B. Refer to the Article "Proposal Preparation," in this section. Specifically designate the labor force required of the Fire Protection Trade Contractor. As part of the mobilization phase of the work, submit resumes for each Keyman including the Project Manager and Project Foreman.
- C. These lists, when approved, will be supplementary to specifications, and no variations therefrom will be permitted except with the approval of the Engineer.
- D. Submittals will not be processed until the requirements of this Article are satisfactorily completed.

2.2 MATERIALS AND EQUIPMENT

- A. All materials and equipment must be new and conform to the grade, quality and standards specified herein.
- B. All equipment offered under these specifications is limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature made available to the public and in effect at the time of opening of bids. Testing agency seals, decals and/or nameplate shall be attached to and visible on all equipment.
- C. Items such as valves, motors, starting equipment, vibration isolating devices, and all other equipment and material, where applicable and practicable, must each be of one manufacturer.
- D. Install equipment in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. Obtain these instructions, which will be considered part of these specifications. Type, capacity and application of equipment must be suitable and operate satisfactorily for the purpose intended in the fire protection systems.

2.3 VIBRATION ELIMINATION

- A. Provide vibration isolation support provisions for all moving or rotating equipment, machinery and transformers when such provisions are not furnished and/or integrally mounted by the equipment manufacturers. Basis of Design is Amber/Booth Company. Comparable product by Korfund Company, Inc. or Mason Industries may be submitted for review. Install in accordance with vibration isolation manufacturer's recommendations unless specified otherwise herein.
- B. Provide all rotating or moving machinery or equipment mounted on, or suspended from, building structure with approved resilient suspension isolation mountings.
- C. Provide vibration isolating connections between all pumps and connecting piping. Length, size, and stiffness as recommended by vibration isolator manufacturer.
- D. Use flexible metallic conduit for all electrical connections to moving or vibrating equipment, such as motors, air compressors, and the like.
- E. Rigid pipes, conduit or other extended machine assemblies connected to vibration isolated equipment are not permitted to be tied in directly with the building construction. Connect such elements to the equipment through flexible fittings, and support using isolating equipment as required.

- F. All systems must operate free from objectionable vibration and noise. Take all necessary steps required to achieve this result without additional cost to the Project.

2.4 EQUIPMENT ANCHOR BOLTS

- A. Provide and set in place at the time concrete foundations, bases or curbs are poured or formed, all necessary anchor bolts as required for the various equipment specified herein, with hook type anchor bolts of proper size and length to suit the apparatus as recommended by the equipment manufacturer. Set bolts in pipe sleeves of approximately twice the bolt diameter and of length equal to the embedded length of the bolt, with sleeves terminating flush with finished surfaces of foundations, bases or curbs.
- B. When the equipment is set in its proper position and aligned with the anchor bolts, the space between the anchor bolts and the inside wall of the sleeves must be completely filled with non-shrink cementitious grout. Grout Basis of Design: Crystex as manufactured by L & M Construction Chemicals, Inc. Comparable product by Master Builders or BASF may be submitted for review.
- C. When a General Construction Trade Contractor provides concrete foundations, bases or curbs, the Fire Protection Trade Contractor is responsible for all anchor bolts required by the equipment he provides, under the Contract Documents. Assign a supervisory representative to be present at the time foundations, bases or curbs are poured or formed. For projects wherein there is no General Construction Trade Contractor, the Fire Protection Trade Contractor is responsible for pouring, locating, and setting equipment foundations, bases and curbs and the
- D. All anchor bolts must be of sufficient strength to withstand any loading imposed by the attached materials or equipment.

2.5 SMOKE/FIRESTOPPING (MATERIALS)

- A. Firestopping materials and systems must consist of commercially manufactured products complying with the following minimum requirements and be asbestos and PCB free:
 - 1. Flame Spread Index: Twenty-five or less when tested in accordance with ASTM E 84.
 - 2. Smoke Density Index: Fifty or less when tested in accordance with ASTM E 84.
 - 3. Nontoxicity: Nontoxic to human beings at all stages of application and during fire conditions.
 - 4. Systems shall comply with Underwriter's Laboratory Listing Requirements.
 - 5. Fire Resistance:
 - a. Materials and systems used to seal penetrations in time rated assemblies must be capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 time temperature fire conditions for 3 hours.
 - b. Materials must not require a rise in temperature to install or activate seal.
 - c. Materials must not contain solvents or require hazardous waste disposal.
 - d. Firestop material must not dissolve in water after curing.
- B. Basis of Design for smoke and firestopping materials is Rectorshield, Inc. Comparable product by Hilti, or 3M may be submitted for review. Refer to Division 07 of these specifications.

- C. Smoke stopping materials must be approved by the authority having jurisdiction.

PART 3 - EXECUTION

3.1 METHOD OF PROCEDURE

- A. The drawings accompanying these specifications are diagrammatic and intended to cover the approximate and relative locations of the building systems.
- B. Installation, connection and interconnection of all components of these systems must be complete and made in accordance with the manufacturers' instructions and best trade practices.
- C. Erect all parts of equipment furnished at such time and in such manner as not to delay or interfere with other Trade Contractors and their work.
- D. Plug all piping and conduit as required during construction to prevent entering of dirt.
- E. Before material is ordered or fabricated, or any work is performed, verify all calculations, sizing, measurements, including lines, grades, pipes and conduit elevations at the building, as applicable, and be responsible for the correctness thereof. No extra compensation will be allowed on account of differences between actual dimensions, routing and measurements and those indicated in the Contract Documents. Any discrepancies discovered must be submitted to the Engineer for consideration before proceeding with the work.
- F. Lay out work and be responsible for the establishment of heights, grades, and the like, for all interior and exterior equipment and systems as applicable, including piping, drains, conduit, and the like, included in Contract Documents, in strict accordance with the intent expressed thereby; and all the physical conditions to be met at the building and finished grade, and be responsible for accuracy thereof. The establishment of the location of all work must be performed in consideration of the finished work. In case of conflict, equipment and/or materials must be relocated without cost to the Project, as directed by the Engineer, regardless of which equipment was installed first. Refer to Article, "Coordination Drawings", in Part 1 of this section.
- G. Cooperate with other Trade Contractors for the proper securing and anchoring of all work included within these specifications. Use extraordinary care in the erection and installation of all equipment and materials to avoid marring surfaces of the work of other Trade Contractors, as each Trade Contractor will be held financially responsible for all such injury caused by the lack of precaution and due to negligence on the part of the Trade Contractor's work force.
- H. Do not run pipe or conduit in any concrete slab three inches (3") or less in thickness. Do not place any pipe or conduit in any slab where the outside diameter of the pipe or conduit is more than one-quarter the thickness of the slab. The sweep of pipe or conduit elbows emerging through concrete slabs must not create any hazard or obstructions.
- I. All piping, conduit and other materials and equipment shown to be mounted below ceilings are to be kept as close to ceiling areas as possible unless otherwise noted.
- J. Install and arrange all equipment, such as valves, flow switches, and the like, that will be concealed in construction, to be fully accessible for adjustment, service and maintenance.

Furnish access doors where required for installation under the General Construction Contract, where applicable. Otherwise, furnish and install all required access doors.

3.2 PROTECTION OF WORK

- A. Provide all piping, equipment, materials and accessories having polished or plated surfaces, machined finishes or unpainted surfaces with a thick coat of a neutral protection grease and carefully cover with thick cloth or heavy building paper held securely in place to protect the finish against damage during the entire period of construction. Protect equipment by the use of canvas tarps, vinyl sheeting or similar materials held securely in place.
- B. Seal all openings in pipes, fittings, conduit and all other materials to exclude dirt, sand, and other foreign materials.
- C. Exercise every precaution to exclude dust, dirt and all other foreign materials from switchgear rooms, transformers, and all mechanical equipment rooms during construction. Rooms and equipment contained therein must be swept and vacuum cleaned at regular intervals. All relays, meters and fire protection equipment containing electrical components must be protected with heavy paper held in place with approved mastic tape to exclude fine dust and particles. Install and maintain sufficient electric heaters in equipment rooms and transformer compartments to keep equipment dry during construction.

3.3 CUTTING AND PATCHING

- A. New Construction:
 - 1. Perform cutting and patching in accordance with Division 01.
 - 2. Provide and set all sleeves, inserts and other items required for the installation of the fire protection work, and take responsibility for their final and permanent locations.
 - 3. Confer with, and give the General Construction Trade Contractor, where applicable, complete information as to size of openings in all construction, so that such openings may be provided as the building progresses. Otherwise, provide openings as required for the fire protection work.
 - 4. If openings are omitted or incorrect through failure to follow these instructions the particular Trade Contractor must, at no additional cost to the project, engage the trade which originally installed the work to cut and patch to the satisfaction of the Engineer.
- B. For existing construction:
 - 1. The General Construction Trade Contractor, where applicable, will perform all cutting and patching required for the work of all trades. Otherwise, all Trade Contractors are responsible for their own cutting and patching.

3.4 CONCRETE AND MASONRY

- A. Provide all cast-in-place concrete, pre-cast concrete and masonry work (brick and block) required for completion of the fire protection work, including interior and exterior concrete slabs.

- B. Engineer will review and approve materials used.
- C. Unless shown or specified otherwise, all equipment foundations and housekeeping pads must be six inches (6") minimum height from floor, of sufficient mass, and secured to the floor.
- D. Refer to Division 03 for concrete specifications.
- E. Unless noted otherwise, concrete bases must be 4" larger than the largest dimension of the base of the supported equipment in both directions. Use 3000 psi, 28 day compressive strength concrete and reinforcement.

3.5 SUPPORTS

- A. Except where noted otherwise in the specifications and shown on drawings, provide all materials, including, but not limited to, equipment supports, supplies and labor necessary as required to adequately support, brace and strengthen new and/or existing equipment and materials installed under/or affected by the fire protection work.
- B. The design, materials, fabrication and erection of structural steel supports must conform to "Specification for Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, "Code of Standard Practice for Steel Buildings and Bridges". Welding, where required, must conform to "Code of Arc and Gas Welding in Building Construction" of the American Welding Society.

3.6 LINTELS

- A. Lintel work to be performed in strict accordance with Division 01, and Architectural and Structural drawings. Refer to Architectural and Structural Contract Documents for lintel schedules and details.
- B. Where lintels are not indicated as being provided by General Construction or Structural Trade Contractors, the Fire Protection Trade Contractor must provide lintels required for the installation and completion of fire protection work.

3.7 MACHINERY GUARDS

- A. Provide OSHA approved expanded sheet steel metal guards over all belt drives, couplings and other moving equipment to protect personnel from injury.
- B. Machinery guards shall comply with OSHA Standards 29 CFR STANDARD NUMBER 1910.212 General Requirements for all Machines; Subpart Number 0; Subtitle - Machinery and Machine Guarding; STANDARD NUMBER 1910.219; Standard Title - Mechanical Power - Transmission Apparatus; Subpart Number 0; Subpart Title - Machinery and Machine Guarding.

3.8 ROOFING WORK

- A. Fire Protection Trade Contractor shall have all roofing and flashing work performed by warranted roofing installer. Contact Owner or original installer for further information. New

penetrations through the roof shall be in full warranty condition. If required by the roof warranty, engage the original roofing installer to perform all roofing and flashing work.

3.9 PAINTING AND FINISHING

- A. All painting, generally, will be provided by the General Construction Trade Contractor, where applicable, except where specifically noted otherwise in the Fire Protection Specifications. Otherwise, all Trade Contractors are responsible for their own painting and finishing.
- B. Equipment and material furnished with factory enamel finish will not be painted unless finish has been damaged, in which case the equipment or material must be refinished by the Trade Contractor who furnished it, to the satisfaction of the Engineer.

3.10 LUBRICATION

- A. Provide proper and necessary lubrication of any items of operating, rotating or moving equipment which is furnished, installed or which must operate as part of the fire protection system.
- B. When an item of operating equipment is furnished and installed by a Trade Contractor, it will be that Trade Contractor's responsibility to accomplish the lubrication.
- C. When an item of operating equipment is furnished by one Trade Contractor and installed by another, it is the responsibility of the Trade Contractor furnishing the equipment to apply the lubricants.
- D. All rotating or moving equipment must be lubricated prior to energizing and operating the equipment. Should the Trade Contractor responsible for the lubrication fail to apply lubricants prior to initial start-up and the equipment is damaged as a result of that Trade Contractor's negligence, that Trade Contractor is required to provide all corrective action necessary including replacement, if required, for the proper operation of equipment.
- E. Lubrication must be accomplished in the manner prescribed or recommended by the manufacturer of the specific item. For motor driven equipment this precaution of lubrication will apply individually to the driver and the driven component.
- F. The lubricants must be of the type, grade, specification and manufacture as prescribed or recommended by the manufacturer of the specific equipment item.
- G. Extend lubrication fittings where required to allow maintenance personnel to lubricate the equipment easily and efficiently.
- H. The Trade Contractor who supplies any item of rotating equipment will have the responsibility of securing written instructions on the lubricating procedure and must furnish not less than one year's supply of all necessary lubricants properly identified so they can be replaced.
- I. Any moving or rotating equipment furnished by the Owner that is to be installed, reused and/or serviced must also be lubricated. Except where noted otherwise in the Contract Documents, the Trade Contractor installing, reusing and/or servicing all such equipment is responsible for the

proper lubrication thereof, including obtaining proper lubricating instructions from the various manufacturers involved, furnishing and applying the necessary lubricants and leaving the Owner with a one (1) year supply of lubricant.

3.11 FIRE PROTECTION TRADE - ELECTRICAL TRADE COORDINATION

- A. Furnish equipment with electrical current characteristics as shown on electrical drawings and specifications.
- B. The nameplate voltage of all motors furnished with mechanical equipment must be within the range of the voltage shown for use with the motor as the upper limit, and 5% less than this voltage as the lower limit.
- C. Fire Protection Trade Contractor must furnish all motors, motor starters, specialty motor controllers, float and pressure switches, temperature control, other special automatic controls as indicated in the Contract Documents for all equipment furnished and/or installed under the fire protection contract except where noted otherwise.
- D. All electrical equipment furnished by the Fire Protection Trade Contractor must be as recommended by the equipment manufacturers, in accordance with the Electrical Specifications for similar items, and of such type as to work properly with automatic temperature control sequences where required.
- E. The Electrical Trade Contractor will provide all push-buttons, safety switches for motors, and wiring from starters to motors and install all starters furnished to him by the Fire Protection Trade Contractor unless otherwise indicated in the Contract Documents.
- F. Where controllers and/or starters are furnished as an integral part of any equipment, the Trade Contractor supplying the equipment must furnish complete wiring between controllers, starters and motors.
- G. The Electrical Trade Contractor must provide disconnect switches for all equipment furnished and/or installed by other Trade Contractors, except where such switches are an integral part of equipment.
- H. Fire Protection Trade Contractor must set all motors and furnish, set and pipe as necessary, float switches, temperature control and other special automatic temperature controls.
- I. Fire Protection Trade Contractor must provide all power and control wiring required by the respective sections of the specifications. The Electrical Trade Contractor will provide all other wiring required for the completion of the work of the Fire Protection Trade Contractor.
- J. Fire Protection Trade Contractor must furnish the Electrical Trade Contractor with complete wiring diagrams as required.
- K. Any electrical work performed by the Fire Protection Trade Contractor must be performed in accordance with the requirements of the ELECTRICAL Section of these specifications.

3.12 ELECTRICAL MOTORS AND STARTERS

- A. All motors furnished by all Trade Contractors, unless specified to the contrary in Contract Documents, must conform to the following requirements:
1. Characteristics, dimensions, tolerances, temperature rise, insulation, rating, noise, vibration, and all other characteristics in accordance with the latest standards of IEEE or NEMA.
 2. Unless required by the driven unit, motors must have normal starting torque, NEMA Design B characteristics. Horsepower rating of motor must be equal to or greater than that required by driven equipment. Current density design of motor rating must be limited so that overload protection provided by standard motor starters will be adequate to prevent damaging overheating during stall, single phasing or slightly prolonged acceleration.
 3. Use NEMA Class A or B insulation with motor frames amply sized to provide a 1.15 service factor at an ambient of 40 deg. C maximum. Insulation systems must be designed for an average life of 60,000 hours.
 4. All motors must be high efficiency. Meet or exceed requirements in NEMA Standard MG1, Table 12-10.
 5. Running power factor must be higher than 0.85 for motors 5 HP to 30 HP and higher than 0.90 for motors 40 HP or larger.
 6. Each motor must be mounted on the same bedplate as the equipment driven and be complete with pulleys, slide rails or flexible couplings as required.
 7. Each Trade Contractor is responsible in each instance for the proper selection of motors of suitable characteristics with details submitted for approval to the Engineer prior to installation.
- B. All starters furnished by all Trade Contractors must conform with the following requirements, unless specified to the contrary in the Contract Documents:
1. All starters for 3-phase equipment must be fully enclosed, across-the-line type equipped with solid state overload protection as herein specified for all three phases, low voltage protection, all necessary auxiliary contacts as required and indicating pilot lights. Starters which are controlled automatically must have two-wire control with "ON-OFF-AUTO" switches. Starters which are controlled manually must have 3-wire control with Start-Stop pushbuttons.
 2. All 3-phase starters remotely controlled must have 120 volt coils and control transformers with disconnecting means. Starters for single phase motors shall be manual toggle switches with thermal overload protection and pilot light. Omit pilot light for unit heaters.
 3. General Purpose NEMA-1 enclosure for indoor use under normal atmospheric conditions. Watertight enclosure NEMA-4 or NEMA-5 for outdoor use or where starters are subjected to the splashing or dripping of water. Explosion-proof enclosure NEMA-7, 9 or 12 for dusty or hazardous locations as required by Article 500 of the National Electrical Code.
 4. Individually equip all starters for three phase motors with solid state adjustable overload protection with automatic protection to prevent single phase operation with the following features:
 - a. Three phase, self-powered with current sensing, phase unbalance and phase loss protection, visible trip indication, trip test function, and power "LED."

- b. Phase loss protection to include automatic restart with a selectable manual switch.
- C. All controllers, starters and other electrical components furnished as an integral part of any apparatus must be furnished complete with integral wiring as required.
- D. So far as is practical, all motors and starters must be of one manufacturer. Basis of Design: General Electric Co. Comparable products by Westinghouse Co., Square-D Co., or Allen-Bradley Co. may be submitted for review.
- E. Submittals for motors and starters must be coordinated with Electrical Trade Contractor.

3.13 ELECTRICAL PROVISIONS FOR PACKAGED FIRE PROTECTION EQUIPMENT

- A. Unless otherwise noted in Fire Protection Specifications, all packaged equipment furnished by Fire Protection Trade Contractor must be complete with the following electrical provisions:
 - 1. General compliance with provisions of the preceding Article, ELECTRICAL MOTORS AND STARTERS.
 - 2. Starting electrical characteristics of all motors and/or starters must be approved by local utility company and Electrical Engineer.
- B. Approved, factory installed and wired starting, operating and control equipment, terminating in terminal strip for single point power wiring connections by Electrical Trade Contractor must conform with the ELECTRICAL Section of these specifications and must include approved branch fuses for branch power circuits.

3.14 PIPING AND CONDUIT UNDER FLOORS

- A. Wherever piping, conduit or piping enclosures are run under a floor slab on grade, the work is to be installed after the General Construction Trade Contractor, where applicable, has brought the sub-grade to the proper level.
- B. Excavate and backfill as required for the installation of fire protection work. The excavation of the sub-grade where required for the installation of the work must be performed, including that for piping, conduit and piping enclosures, by the Fire Protection Trade Contractor. When the installation is completed and satisfactorily tested, the remaining space shall be filled with crushed stone or other material similar to that to be used by the General Construction Trade Contractor, where applicable, for the sub-base. The backfill must be stabilized by hand or pneumatic tamping as directed by the Engineer and must be returned to the original sub-grade level.
- C. No piping, conduit or piping enclosures is to be installed in the stone sub-base which is part of the General Construction Trade Contractor's, where applicable, work unless specific permission is granted by the Engineer.
- D. Where piping is noted to be installed in enclosures, such as split terra cotta pipe, necessary protection of the insulation, arrangement and installation will be as hereinafter described in the detailed technical specifications.

- E. Where required by drawing notes, specifications, or applicable electrical codes, conduits installed under floors must be encased in concrete, conforming to the Division 03 specifications.

3.15 PIPING AND EQUIPMENT IDENTIFICATION

- A. Basis of Design for pipe markers is Setmark snap on type SNA by Seton Nameplate Corporation. Comparable products by Marking Services, Inc. or Brady Worldwide may be submitted for review. Pipe markers must comply with OSHA Standards. Wording and color coding must conform to the current edition of ANSI/ASME A13.1.
- B. Mark all systems of piping with markers 12 foot maximum centers.
- C. Markers must indicate the following:
 - 1. Pipe contents in legend form.
 - 2. Size of piping.
 - 3. Direction of flow in piping.
- D. Identify all valves and other parts of fire protection systems by means of 2" round brass, aluminum or plastic tags. Tags must have engraved or stamped letters or numbers ½" high. Fasten tags securely with brass "S" hooks or chains. Basis of Design for tags is Seton Corporation. Comparable products by Marking Services, Inc. or Brady Worldwide may be submitted for review.
- E. Provide ½" scale diagrams showing location, number and service or function of each tagged item. Frame diagrams in approved frame with clear Lucite front, secured to walls in location as directed by Owner. Provide two (2) separate copies of each diagram, permanently framed and covered as two (2) separate items.
- F. Identify all equipment as to nature, service and purpose by means of permanently attached plastic nameplates having ½" high letters, dull black outside and white core. Nameplates of approved size, beveled edges and engraved through black to white core. Basis of Design for nameplates is Seton Corp. Comparable products by Marking Services, Inc. or Brady Worldwide may be submitted for review. Nameplates shall indicate equipment identification names and numbers as approved by the Owner.

3.16 ABANDONMENT, REMOVAL AND RELOCATION

- A. Perform all abandonment, removal and relocation work required for completion of fire protection systems.
- B. Removals shown on drawings are a general indication only, and may not necessarily indicate the full extent of removals which may be required to complete this work.
- C. Where existing partitions, walls, ceilings and floors are to be removed, all piping, conduits, materials and equipment attached or fastened thereto or within, as applicable, must be carefully removed.

- D. Where work under this contract interferes with the existing construction, ductwork, piping, conduit or equipment, remove all such materials and route new work to clear the obstruction. Provide additional piping, conduits, ducts, and material of the same design and quality if the piping and/or conduit is to be continued in use.
- E. Disconnect and remove all accessible piping, conduit, ductwork, materials, fixtures and equipment not required in the new systems. Plug all outlets at the main or riser connection.
- F. Removed materials not desired by the Owner and not to be reset and not specified nor indicated to be reused, become the property of the Fire Protection Trade Contractor and must be promptly removed from site.
- G. All demolition work is subject to the direction and approval of the Engineer and must be performed in such manner as not to interfere with the normal operation of the building.
- H. Relocate existing utilities and/or equipment that must remain to maintain operation of building or parts of building outside the work area.
- I. Equipment Pad Removal:

- 1. Remove all concrete pads and equipment support structure material related to the Fire Protection Trade, not indicated or specified for reuse. Remove concrete pads to one (1) inch below adjacent concrete floor surface. Exterior slabs shall be broken and removed as waste materials.
- 2. Cut-off reinforcement and anchor bolts at or below level of pad removal.

- a. Resurface area level with adjacent concrete floor surface using a heavy duty aggregate concrete topping consisting of Portland cement Type I or Type III conforming to ASTM C150 with aggregate graded by weight to pass sieves as follows:

Fine (Thin Coat)		or	Course (Heavy Coat)	
3/8"	100%		1/2"	100%
No. 4	95-100%		3/8"	30-50%
No. 8	65-80%		No. 4	0-15%
No. 16	45-65%		No. 8	0-5%
No. 30	25-45%		No. 100	0-5%

- b. Topping mix must contain a high range water reducing admixture (super plasticizer) ASTM C494, Type F or Type G.
- c. Coat surface with epoxy bonding agent prior to application of concrete topping.
- d. Produce a heavy duty concrete topping with the following characteristics:

Compressive Strength	5000 psi at 28 days
Slump	8" maximum
Water to Cement Ratio	0.44.

3.17 SMOKE AND FIRESTOPPING (METHODS)

- A. Installation of materials must be performed by applicator/installers qualified, trained and approved by the manufacturer of the materials, and be installed in accordance with ASTM E 814.
- B. Install smoke and firestopping at locations required, shown, or specified in accordance with applicable codes, manufacturer's written instructions, and test report, applying to the specific trade equipment as applicable. Cutting and patching of construction and providing sleeves, where required, is shown on drawings or specified in other sections.
 - 1. Filling of Voids: Smoke and firestopping materials must completely fill void spaces regardless of geometric configuration, subject to tolerances established by the manufacturer. Smoke and firestopping for filling voids in floors in which the smallest dimension of the void is 4 in. or more must support the same load as the floor is designed to support or must be protected by a permanent barrier to prevent loading or traffic in the smoke or firestopped areas.
 - 2. Electrical Cables or Conduits: Smoke and firestopping at penetrations of electrical cables or conduits must comply with the requirements of NFPA 70.
 - 3. Where smoke and firestopping of penetrations in floors, walls and partitions that will be exposed in completed construction, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and provide escutcheons or other trim.
 - 4. Schedule the installation and required inspection of smoke and firestops for penetrations that will be concealed in completed construction prior to erection of floors, walls, and partitions that would permanently conceal the penetrations.
- C. All areas of smoke and firestopping installation must be accessible until inspection by the applicable code authorities.

3.18 SUBSURFACE CONCEALED UNKNOWN PHYSICAL CONDITIONS

- A. Subsurface, or otherwise concealed physical conditions which (1) do not differ materially from those indicated in the Project Contract Documents; (2) affect fire protection; (3) do not differ materially from those ordinarily found to exist, and which are generally recognized as inherent in the fire protection construction activities of the character provided for in the Project Contract Documents, are to be anticipated by the Fire Protection Trade Contractor, and included in the basic fire protection work.
- B. Unknown physical conditions: which are of an unusual nature; which are materially different in subsurface (otherwise concealed) physical conditions; which affect fire protection work; which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character found in the Project Contract Documents, are the basis for, and require notice by, the applicable Trade Contractor, promptly, before such conditions are disturbed. Such conditions may become the basis for a legitimate claim under "Changed Conditions," affecting the cost, and/or schedule of the work. During the work, the Fire Protection Trade Contractors shall provide reasonable, incidental on-site review, survey and measurements to assist in quantification of such conditions.

3.19 CONCRETE PATCHING (PROCEDURE)

- A. Remove any loose debris, chipped or cracked portions of concrete, and any grease, oil, dirt or other coating materials from the concrete to be patched.
- B. Apply epoxy bonding adhesive to the clean dry surface with a brush or roller to briefly flood the surface allowing good penetration, if completely absorbed, apply additional material. Adhesive Basis of Design: Edison Coatings Inc. Flexi-Bond 540. Comparable product by Sika Corp. or Euclid Chemical Co. may be submitted for review. Refer to Division 03 of these specifications.
- C. Apply new cementitious mortar patch to surface immediately after applying bonding adhesive, bonding agent should be wet while applying concrete patch. Mortar patch equal to Moxie International 2000 Super Patch. Comparable product by Sika Corp. or Euclid Chemical Co. may be submitted for review. Refer to Division 03 of these specifications.
- D. Work patch into any cracks or crevices with a brush, then apply remainder of patch and trowel until level and smooth.
- E. Do not apply patch below 45 deg. F.

3.20 TEMPORARY PARTITIONS

- A. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas. Refer to Division 01 of these specifications.

END OF SECTION 210010

SECTION 210513 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating.
- G. Insulation: Class F.
- H. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 210513

SECTION 210517 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

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. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Advance Products & Systems, Inc;
 - 2. CALPICO, Inc;
 - 3. GPT; an EnPro Industries company.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.
- C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.
- D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Advance Products & Systems, Inc;.
 - 2. Metraflex Company (The);.
 - 3. Proco Products, Inc;.
- B. Description:
 - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 2. Designed to form a hydrostatic seal of 20 psig minimum.
 - 3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
 - 4. Pressure Plates: Carbon steel.
 - 5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- A. Sleeves are not required for core-drilled holes. Coordinate sizes and locations with the structural engineering drawings.
- B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 3. Using grout, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- C. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

- D. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Steel pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:

- a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
- a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - b. Piping NPS 6 and Larger: Steel pipe sleeves.

END OF SECTION 210517

SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

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. Escutcheons.
 - 2. Floor plates.

1.3 DEFINITIONS

- A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BrassCraft Manufacturing Co.; a Masco company.
 - 2. Dearborn Brass.
 - 3. ProFlo; a Ferguson Enterprises, Inc. brand.

2.2 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

- D. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- E. Split-Plate, stamped-steel Type: With polished, chrome-plated finish; concealed hinge; and spring clip fasteners.

2.3 FLOOR PLATES

- A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece steel with polished, chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Piping: One-piece, floor plate.
 - 2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 210518

SECTION 210523 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

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. Two-piece ball valves with indicators.
 - 2. Bronze butterfly valves with indicators.
 - 3. Iron butterfly valves with indicators.
 - 4. Check valves.
 - 5. Bronze OS&Y gate valves.
 - 6. Iron OS&Y gate valves.
 - 7. NRS gate valves.
 - 8. Indicator posts.
 - 9. Trim and drain valves.

1.3 DEFINITIONS

- A. NRS: Nonrising stem.
- B. OS&Y: Outside screw and yoke.
- C. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and weld ends.
 - 3. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:

1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
- D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of valve from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
1. Fire Main Equipment: HAMV - Main Level
 - a. Indicator Posts, Gate Valve: HCBZ - Level 1
 - b. Ball Valves, System Control: HLUG - Level 3
 - c. Butterfly Valves: HLXS - Level 3
 - d. Check Valves: HMER - Level 3
 - e. Gate Valves: HMRZ - Level 3
 2. Sprinkler System & Water Spray System Devices: VDBG - Main Level
 - a. Valves, Trim and Drain: VQGU - Level 1
- B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
1. Automated Sprinkler Systems:
 - a. Indicator posts.
 - b. Valves.
 - 1) Gate valves.
 - 2) Check valves
 - 3) Miscellaneous valves.
- C. ASME Compliance:
1. ASME B1.20.1 for threads for threaded-end valves.
 2. ASME B16.1 for flanges on iron valves.
 3. ASME B31.9 for building services piping valves.

- D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- E. NFPA Compliance for valves:
 - 1. Comply with NFPA 13, NFPA 14, NFPA 20, and NFPA 24.
- F. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher, as required by system pressures.
- G. Valve Sizes: Same as upstream piping unless otherwise indicated.
- H. Valve Actuator Types:
 - 1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
 - 2. Handwheel: For other than quarter-turn trim and drain valves.
 - 3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.3 TWO-PIECE BALL VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ames Fire & Waterworks; A WATTS Brand.
 - 2. NIBCO INC.
 - 3. Victaulic Company.
- B. Description:
 - 1. UL 1091, except with ball instead of disc and FM Global approved for indicating valves (butterfly or ball type), Class Number 1112.
 - 2. Minimum Pressure Rating: 175 psig.
 - 3. Body Design: Two piece.
 - 4. Body Material: Forged brass or bronze.
 - 5. Port Size: Full or standard.
 - 6. Seats: PTFE.
 - 7. Stem: Bronze or stainless steel.
 - 8. Ball: Chrome-plated brass.
 - 9. Actuator: Worm gear
 - 10. Supervisory Switch: Internal or external.
 - 11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
 - 12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.4 BRONZE BUTTERFLY VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ALEUM USA.
 - 2. Globe Fire Sprinkler Corporation.

3. Milwaukee Valve Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum: Pressure rating: 175 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Bronze or Stainless steel with EPDM coating.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2 and larger: Grooved ends.

2.5 IRON BUTTERFLY VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ALEUM USA.
2. Globe Fire Sprinkler Corporation.
3. Milwaukee Valve Company.
4. NIBCO INC.
5. Victaulic Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with epoxy coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Body Design: Lug or wafer Grooved-end connections.

2.6 CHECK VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. NIBCO INC.
3. Victaulic Company.
4. Viking Corporation.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.7 IRON OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. NIBCO INC.
2. Victaulic Company.
3. WATTS.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.8 NRS GATE VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mueller Co.
2. NIBCO INC.
3. Victaulic Company.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.

4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.9 INDICATOR POSTS

A. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.
2. Base Barrel Material: Cast or ductile iron. All Indicator posts associated with exterior valves shall be ductile iron.

2.10 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Milwaukee Valve Company.
 - b. NIBCO INC.
 - c. Potter Roemer LLC; a Division of Morris Group International.
 - d. Victaulic Company.
2. Description:
 - a. Pressure Rating: 175 psig.
 - b. Body Design: Two piece.
 - c. Body Material: Forged brass or bronze.
 - d. Port size: Full or standard.
 - e. Seats: PTFE.
 - f. Stem: Bronze or stainless steel.
 - g. Ball: Chrome-plated brass.
 - h. Actuator: Handlever.
 - i. End Connections for Valves NPS 1 through NPS 1-1/2: Threaded ends.
 - j. End Connections for Valves NPS 2 and NPS 2-1/2: Grooved ends.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION, GENERAL

- A. Comply with requirements in the following Sections for specific valve-installation requirements and applications:
 - 1. Refer to applicable Division 21 Sections.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply, except from fire-department connections. Install permanent identification signs, indicating portion of system controlled by each valve.
- C. Install double-check valve assembly in each fire-protection water-supply connection.
- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.
- G. Install valve tags. Comply with requirements in applicable Division 21 Sections and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.
- H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.
- I. Install backflow preventers in potable water supply sources.

END OF SECTION 210523

SECTION 210529 - HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fastener systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. NFPA Compliance: Comply with NFPA 13.
- D. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
 - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hilti, Inc.;
 - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.;
 - c. MKT Fastening, LLC;

- B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hilti, Inc.;
 - b. ITW Ramset/Red Head; Illinois Tool Works, Inc.;
 - c. MKT Fastening, LLC;
 - 2. Indoor Applications: Stainless steel.
 - 3. Outdoor Applications: Stainless steel.

2.5 MATERIALS

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout, suitable for interior and exterior applications.
 - 1. Properties: Non-staining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. 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.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

- A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes per NFPA 13 and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating Above Ambient Air Temperature: Clamp size to match OD of insulation/jacket.
 - b. Coordinate installation of hangers with insulation and heat tracing.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup:
 - 1. Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

- E. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 12.
 - 2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 12 if little or no insulation is required.
 - 3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
 - 4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
 - 5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 12.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 12 if longer ends are required for riser clamps.
- G. Hanger-Rod Attachments: Comply with NFPA requirements.
- H. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. C-Clamps (MSS Type 23): For structural shapes.
 - 3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- I. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- J. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 210529

SECTION 210533 - HEAT TRACING FOR FIRE-SUPPRESSION PIPING

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 heat tracing for fire-suppression piping with the following electric heating cables:
 - 1. Self-regulating, parallel resistance.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
 - 2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
- B. Shop Drawings: For electric heating cable.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 10 years for the heat trace cables and 2 year for the controllers from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HEATING CABLES

- A. Products shall be as manufactured by one of the following (Basis of design: NVent: XL-Trace):
 - 1. nVent: Raychem.
 - 2. Delta-Therm Corporation.
 - 3. Orbit Manufacturing.
- B. Comply with IEEE 515.1.
- C. Heating Element: Nickel plated copper bus wire with self-regulating conductive core, modified polyolefin inner jacket, tinned copper braid, Modified polyolefin outer jacket.
- D. Powered Connection Kits – Waterproof, UV-resistant enclosure. Kit includes 5' power lead wires, a conduit fitting; pipe mounting bracket and end seal. The kits shall be for one, two or three heating cables. Basis of design: NVent RayClic.

2.2 CONTROLS

- A. Controller: Single-Point Electronic Controller for fire protection pipe heat tracing systems. Unit shall be UL listed designed for fire sprinkler/fire suppression systems. Controller shall be complete with 5" color touch screen display; two temperature sensors - control by line-sensing or ambient sensing and have proportional ambient sensing control modes; measure ground fault current sensing and relaying equipment compliant with UL 1053; autocycle feature to automatically and regularly test the system for problems; alarm relay for remote alarm annunciation to the fire panel; real time clock; password protected; circuit breaker; and USB connection. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
 - 1. Temperature sensor:
 - a. 2-wire thermistor 2KOhm.
 - b. Sensor cable length: 10ft cable extension up to 328 ft / 2 X16 AWG. Coordinate final length in the field.
 - c. Sensor temperature range: -40F to 194F.
 - 2. Alarms:
 - a. Low and high temperature alarm ranges (35F- low/100F-high settings).
 - b. Ground fault alarm and trip.

3. Supervisory relay to provide a supervisory signal to a fire alarm system for any of the following alarm conditions:
 - a. Ground fault current.
 - b. Low system temperature.
 - c. High system temperature.
 - d. Temperature sensor failure.
 - e. Internal error.
 - f. Loss of continuity.
 - g. Loss of incoming supply voltage.
4. Memory: all parameters stored in non-volatile memory, and clock backup for 10 days.
- B. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
- C. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.

2.3 ACCESSORIES

- A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer or as recommended in writing by manufacturer.
- B. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
 1. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install electric heating cable where indicated and according to NFPA 70 and NFPA 13.

- B. Install electric heating cable across expansion joints according to manufacturer's written instructions; use cable to allow movement without damage to cable.
- C. Install electric heating cables after piping has been tested and before insulation is installed.
- D. Install electric heating cables according to IEEE 515.1.
- E. Install insulation over piping with electric cables according to Section 210700 "Fire-Suppression Systems Insulation."
- F. Install warning tape on piping insulation where piping is equipped with electric heating cables every ten feet.
- G. Set field-adjustable switches and circuit-breaker trip ranges.

3.3 CONNECTIONS

- A. Ground equipment and connect wiring according to applicable Division 26 Sections.
- B. Connect heat-tracing controls to fire-alarm system according to NFPA 13.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
 - 2. Test cables for electrical continuity and insulation integrity before energizing.
 - 3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
- C. Cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 PROTECTION

- A. Protect installed heating cables, including non-heating leads, from damage during construction.
- B. Remove and replace damaged heat-tracing cables.

END OF SECTION 210533

SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

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. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - c. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: stainless steel, 0.025 inch thick, with predrilled holes for attachment hardware.
 3. Letter Color: White.
 4. Background Color: Black.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 6. Minimum Letter Size: 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brimar Industries, Inc.
 2. Craftmark Pipe Markers.
 3. Seton Identification Products; a Brady Corporation company.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. Seton Identification Products; a Brady Corporation company.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.
- F. Pipe-Label Colors:
 - 1. Background Color: Safety Red.
 - 2. Letter Color: White.

2.4 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. Seton Identification Products; a Brady Corporation company.
- B. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: stainless steel, 0.025 inch thick, with predrilled holes for attachment hardware.
 - 2. Fasteners: Brass wire-link chain or S-hook.
 - 3. Valve-Tag Color: Safety Red.
 - 4. Letter Color: White.

- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brimar Industries, Inc.
 2. Craftmark Pipe Markers.
 3. Seton Identification Products; a Brady Corporation company.
- B. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size: Approximately 4 by 7 inches.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Color: Safety Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit a view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
 - 1. Valve-Tag Size and Shape:
 - a. Fire-Suppression Standpipe: 1-1/2 inches, round.
 - b. Wet-Pipe Sprinkler System: 1-1/2 inches, round.
 - c. Dry-Pipe Sprinkler System: 1-1/2 inches, round.
 - d. Pre-action Sprinkler System: 1-1/2 inches, round.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 210553

SECTION 210700 - FIRE-SUPPRESSION SYSTEMS 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. Section includes insulating the following fire protection piping services:
 - 1. Fire pump suction and discharge, heat traced, piping through unconditioned spaces.
 - 2. Existing wet system riser routed between columns H & J on parking garage level B.
 - 3. All other wet-pipe sprinkler piping exposed, or potentially exposed, to freezing conditions.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings:
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 4. Detail application of field-applied jackets.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials. Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in applicable Division 21 sections.
- B. Coordinate clearance requirements with piping Installer for piping insulation application and with equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Diesel Engine Exhaust Insulation Schedule"; "Equipment Insulation Schedule"; "Piping Insulation Schedule, General"; "Indoor Piping Insulation

Schedule"; and "Outdoor, Aboveground Piping Insulation Schedule" articles, as applicable, for where insulating materials shall be applied.

- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- E. Calcium Silicate: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C533, Type I or Type II.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; a Berkshire Hathaway company; Thermo-12 Gold.
 - b. Knauf Insulation;
 - c. Manson Insulation, Inc.;
 - 2. Prefabricated Fitting Covers: Comply with ASTM C450 and ASTM C585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
- F. Mineral-Fiber, Performed Pipe: Mineral or glass fibers bonded with a water -repellent thermosetting resin. Comply with ASTM C547.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; a Berkshire Hathaway company; Thermo-12 Gold.
 - b. Knauf Insulation;
 - c. Manson Insulation, Inc.
 - 2. Preformed pipe insulation: Type I, Grade A with factory applied ASJ-SSL.
 - 3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
 - 4. Factory-applied jacket requirements are specified in "Factory-Applied jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 - 2. Service Temperature Range: 0 to plus 180 deg F.
 - 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 - 4. Color: White.

2.5 LAGGING ADHESIVES

- A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
 - 2. Service Temperature Range: 0 to plus 180 deg F.
 - 3. Color: White.

2.6 SEALANTS

- A. Materials shall be as recommended by insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.
- B. Joint Sealants:
 - 1. Permanently flexible, elastomeric sealant.
 - 2. Service Temperature Range: Minus 150 to plus 250 deg F.
 - 3. Color: White or gray.
- C. Metal Jacket Flashing Sealants:
 - 1. Fire- and water-resistant, flexible, elastomeric sealant.
 - 2. Service Temperature Range: Minus 40 to plus 250 deg F.

3. Color: Aluminum.

D. ASJ Flashing Sealants:

1. Fire- and water-resistant, flexible, elastomeric sealant.
2. Service Temperature Range: Minus 40 to plus 250 deg F.
3. Color: White.

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C1136, Type I unless otherwise indicated.

B. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B209; Alloy 3003, 3005, 3105, or 5005; Temper H-14.
 - a. Finish and thickness are indicated in field-applied jacket schedules.
 - b. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are unavailable.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.10 SECUREMENTS

A. Bands:

1. Aluminum: ASTM B209; Alloy 3003, 3005, 3105, or 5005; Temper H-14; 0.020 inch thick, 3/4 inch wide with wing seal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended in writing by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended in writing by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.

- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
- E. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
7. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

3.6 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation sections of insulation are unavailable, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation same as pipe insulation.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and applicable insulation joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c..

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are unavailable, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are unavailable, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with aluminum bands 12 inches o.c. and at end joints.

3.9 FINISHES

- A. Do not field paint aluminum jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect pipe, fittings, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location of straight pipe, one location of threaded fittings, and one location of welded fittings for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Indoor fire-suppression piping in conditioned spaces.
 - 2. Underground piping.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE (Exposed Piping in unconditioned Parking Garage between Pump Room and Mechanical Room; Exg. exposed piping on level B of the unconditioned Parking Garage routed between columns H and J).

- A. Outdoor Fire-Suppression Piping Filled with water:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Calcium Silicate: 2 inches thick. – or-
 - b. Mineral Fiber: 2 inches thick.
 - 2. Coordinate with heat tracing.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE (Exposed Piping in Parking Garage between Pump Room and Mechanical Room; Exg. exposed piping on level B of the unconditioned Parking Garage routed between columns H and J).

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Outdoor Fire-Suppression Piping Filled with water:
 - 1. Aluminum, Smooth or Corrugated: 0.024 inch thick.
- C. Coordinate with heat tracing.

END OF SECTION 210700

SECTION 211100 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

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 fire-suppression water-service piping and related components outside the building and service entrance piping through floor into the building and service entrance piping through wall into the building and the following:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-suppression specialty valves.
 - 3. Alarm devices.
- B. Coordinate water meter requirements with the water authority.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Detail routing of sprinkler service.
 - 2. Include diagrams for power, signal, and control wiring if applicable.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
 2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. 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.
- D. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
 2. Protect valves against damage to threaded ends and flange faces.
 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping 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.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Suppression Water-Service Piping: 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 water-distribution service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.
- B. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Flanges: ASME B16.1, Class 125, cast iron.

2.2 SPECIAL PIPE FITTINGS

- A. Ductile-Iron Deflection Fittings:
 1. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 2. Pressure Rating: 250 psig minimum.

2.3 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
 1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
 2. Standard: AWWA C219.
 3. Center-Sleeve Material: Manufacturer's standard.
 4. Gasket Material: Natural or synthetic rubber.
 5. Pressure Rating: 200 psig minimum.
 6. Metal Component Finish: Corrosion-resistant coating or material.

2.4 PRESSURE-REDUCING VALVES

A. Water Control Valves:

1. Water Control Valves shall be manufactured by one of the following:
 - a. Apollo Valves.
 - b. Watts.
 - c. Zurn Industries.
2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
3. Pressure Rating: Initial pressure of 150 psig minimum.
4. Main Valve Body: Cast or ductile iron with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.

2.5 BACKFLOW PREVENTERS

A. Double-Check, Backflow-Prevention Assemblies:

1. Water regulation shall be manufactured by one of the following:
 - a. Apollo Valves.
 - b. Watts.
 - c. Zurn Industries.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
5. Body Material: stainless steel
6. End Connections: flanged.
7. Configuration: Coordinate final configuration in field.
8. Accessories: OS&Y gate valves with flanged ends on inlet and outlet.

B. Double-Check, Detector-Assembly Backflow Preventers:

1. Water regulation shall be manufactured by one of the following:
 - a. Apollo Valves.
 - b. Watts.
 - c. Zurn Industries.
2. Standards: ASSE 1048 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
5. Body Material: Body Material: stainless steel
6. End Connections: Flanged.
7. Configuration: Coordinate final configuration in field.

8. Accessories:

- a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
- b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

C. Backflow Preventer Test Kits:

- 1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with excavating, trenching, and backfilling requirements in applicable Division 21 Sections.

3.2 PIPING INSTALLATION

- A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- B. Comply with NFPA 24 for fire-service-main piping materials and installation.
- C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- D. Bury piping with depth of cover over top at least, with top at least 12 inches below level of maximum frost penetration.
- E. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- F. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.
 - 1. Terminate fire-suppression water-service piping within the building at the wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.
- G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- H. Comply with requirements for fire-suppression water-service piping inside the building in accordance with the applicable Division 21 sections.

- I. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in applicable Division 21 sections.
- J. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in applicable Division 21 sections.

3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.
- B. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment.
- C. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
- D. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
- E. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.
- F. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.
- G. Do not use flanges or unions for underground piping.

3.4 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
 - 3. Bolted flanged joints.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:
 - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install ball drip valves at each check valve for fire-department connection to mains.
- B. Install protective pipe bollards on two sides of] each freestanding fire-department connection.

3.7 ALARM DEVICE INSTALLATION

- A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.
- B. Supervisory Switches: Supervise valves in open position.
 - 1. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.
- C. Locking and Sealing: Secure unsupervised valves as follows:
 - 1. Valves: Install chain and padlock on open OS&Y gate valve.
 - 2. Post Indicators: Install padlock on wrench on indicator post.
- D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.
- E. Connect alarm devices to building's fire-alarm system.

3.8 CONNECTIONS

- A. Connect fire-suppression water-service piping to existing water main.

3.9 FIELD QUALITY CONTROL

- A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.
- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

- C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare test and inspection reports.

3.10 IDENTIFICATION

- A. Install continuous underground, detectable, warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping.

3.11 CLEANING

- A. Clean and disinfect fire-suppression water-service piping as follows:
 - 1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow it to stand for three hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

3.12 PIPING SCHEDULE

- A. Underground fire-suppression water-service piping shall be one of the following:

1. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile-standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
- B. Aboveground fire-suppression water-service piping shall be grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
 1. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and restrained, gasketed joints.
- C. Underground fire-suppression water-service shutoff valves and larger shall be one of the following:
 1. 250-psig, AWWA, iron, nonrising-stem, resilient-seated gate valves.
 2. 250-psig, UL-listed or FM Global-approved, iron, nonrising-stem gate valves.
- D. Indicator-post underground fire-suppression water-service valves shall be 250-psig, UL-listed or FM Global-approved, iron, nonrising-stem gate valves with indicator-post flange.
- E. Standard-pressure, aboveground fire-suppression water-service shutoff valves shall be one of the following:
 1. 250-psig, AWWA, iron, OS&Y, resilient-seated gate valves.
 2. 250-psig, UL-listed or FM Global-approved, iron, OS&Y gate valves.
 3. AWWA or UL-listed or FM Global-approved butterfly valves.

END OF SECTION 211100

SECTION 211119 – FIRE DEPARTMENT CONNECTIONS

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. Flush-type fire-department connections.
 - 2. Exposed-type fire-department connections.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-department connection.

PART 2 - PRODUCTS

2.1 FIRE-DEPARTMENT CONNECTION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Elkhart Brass Mfg. Co., Inc.
 - 2. Guardian Fire Equipment, Inc.
 - 3. Potter Roemer LLC; a Division of Morris Group International.
- B. Standard: UL 405.
- C. Type: Flush, for wall mounting – or – exposed, projecting for wall mounting.
- D. Pressure Rating: 175 psig minimum.
- E. Body Material: Corrosion-resistant metal.
- F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

- G. Caps: Brass, lugged type, with gasket and chain.
- H. Escutcheon Plate: Rectangular or round, brass, wall type.
- I. Outlet: With pipe threads.
- J. Number of Inlets: Six.
- K. Outlet Location: Back.
- L. Escutcheon Plate Marking: Similar to "AUTO SPKR" or "STANDPIPE."
- M. Finish: Rough chrome plated.
- N. Outlet Size: NPS 8.

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 fire-department connections.
- B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Coordinate final connection types with the local fire marshall.

3.2 INSTALLATION

- A. Install wall-type or exposed type fire-department connections.
- B. Install two protective pipe bollards on sides of each fire-department connection.
- C. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 211119

SECTION 211313 - WET-PIPE SPRINKLER 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. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gauges.

- B. Related Requirements:

1. Comply with requirements in applicable Division 21 Sections.

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Domestic water piping.
 - 2. Compressed air piping.
 - 3. HVAC hydronic piping.
 - 4. Ductwork
 - 5. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
- B. Qualification Data: For qualified Installer and professional engineer.
- C. Design Data:
 - 1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations.
- D. Welding certificates.
- E. Field Test Reports:
 - 1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
 - 2. Fire-hydrant flow test report.
- F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 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. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of sprinkler service in respective areas.
2. Do not proceed with interruption of sprinkler service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.
- C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- D. Delegated Design: Engage a qualified professional engineer, to design wet-pipe sprinkler systems.
 1. Sprinkler system design shall be approved by authorities having jurisdiction.
 - a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - b. Sprinkler Occupancy Hazard Classifications in accordance with NFPA 13:
 - 1) Automobile Parking Areas: Ordinary Hazard, Group 1.
 - 2) Building Service Areas: Ordinary Hazard, Group 1.
 - 3) Electrical Equipment Rooms: Ordinary Hazard, Group 1.

- 4) Traction Elevator Machine Room and Hoistway: Ordinary Hazard, Group 1.
- 5) General Storage Areas: Ordinary Hazard, Group 1.
- 6) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
- 7) Office and Public Areas: Light Hazard.

2.2 STEEL PIPE AND FITTINGS

- A. Standard-Weight, Schedule 40 Black-Steel Pipe: ASTM A53/A53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
- C. Uncoated-Steel Couplings: ASTM A865/A865M, threaded.
- D. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
 1. Pipe-Flange Gasket Materials: EPDM rubber gasket.
 - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
 - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- E. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
 1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- F. Grooved-Joint, Steel-Pipe Appurtenances:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Company.
 - b. Anvil International.
 - c. CPS Products, Inc.
 - d. Grinnell Supply Sales Co.
 2. Pressure Rating: 175-psig minimum.
 3. Painted Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
 - 1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Alarm Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc. (The).
 - c. Victaulic Company.
 - d. Viking Corporation.
 - 2. Standard: UL 193.
 - 3. Design: For horizontal or vertical installation.
 - 4. 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.

2.4 AIR VENT

- A. Manual Air Vent/Valve:
 - 1. Description: Ball valve that requires human intervention to vent air.
 - 2. Body: Forged brass.
 - 3. Ends: Threaded.
 - 4. Minimize Size: 1/2 inch.
 - 5. Minimum Water Working Pressure Rating: 300 psig.
- B. Automatic Air Vent Assembly:
 - 1. Description: Automatic air vent assembly that automatically vents trapped air without human intervention, including Y-strainer and ball valve in a pre-piped assembly.
 - 2. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler system.
 - 3. Vents oxygen continuously from system.
 - 4. Float valve to prevent water discharge.
 - 5. Minimum Water Working Pressure Rating: 175 psig.

2.5 SPRINKLER PIPING SPECIALTIES

- A. Branch Outlet Fittings:
 - 1. Standard: UL 213.
 - 2. Pressure Rating: 175-psig minimum.
 - 3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 - 4. Type: Mechanical-tee and -cross fittings.
 - 5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 - 6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
 - 7. Branch Outlets: Grooved, plain-end pipe, or threaded.
- B. Flow Detection and Test Assemblies:
 - 1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
 - 2. Pressure Rating: 175-psig minimum.
 - 3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
 - 4. Size: Same as connected piping.
 - 5. Inlet and Outlet: Threaded or grooved.
- C. Sprinkler Inspector's Test Fittings:
 - 1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
 - 2. Pressure Rating: 175-psig minimum.
 - 3. Body Material: Cast- or ductile-iron housing with sight glass.
 - 4. Size: Same as connected piping.
 - 5. Inlet and Outlet: Threaded.
- D. Adjustable Drop Nipples:
 - 1. Standard: UL 1474.
 - 2. Pressure Rating: 250-psig minimum.
 - 3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
 - 4. Size: Same as connected piping.
 - 5. Length: Adjustable.
 - 6. Inlet and Outlet: Threaded.

2.6 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Reliable Automatic Sprinkler Co., Inc. (The).
 - 2. Victaulic Company.
 - 3. Viking Corporation.
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- C. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

- D. Automatic Sprinklers with Heat-Responsive Element.
- E. Sprinkler Finishes: Chrome plated sprinkler escutcheons for concealed, flush and recessed type and side wall type.
- F. Sprinkler Guards:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc. (The).
 - b. Victaulic Company.
 - c. Viking Corporation.
 - 2. Standard: UL 199.
 - 3. Type: Wire cage with fastening device for attaching to sprinkler.

2.7 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Notification Appliances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Lite Alarms; Honeywell International, Inc.
 - b. Notifier; Honeywell International, Inc.
 - c. Potter Electric Signal Company, LLC.
 - 2. Electric Bell:
 - a. Standard: UL 464.
 - b. Type: Vibrating, metal alarm bell.
 - c. Size: 8-inch minimum- diameter.
 - d. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - e. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.
- C. Water-Flow Indicators:
 - 1. Standard: UL 346.
 - 2. Water-Flow Detector: Electrically supervised.
 - 3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - 4. Type: Paddle operated.

5. Pressure Rating: 250 psig.
6. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Standard: UL 346.
2. Type: Electrically supervised water-flow switch with retard feature.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.
5. 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.

2.8 PRESSURE GAUGES

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gauge Range: 0- to 250-psig minimum.
- D. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING (Courthouse)

- A. Connect sprinkler piping to water-service piping for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-service piping.

3.3 WATER-SUPPLY CONNECTIONS (Parking Garage)

- A. Connect sprinkler piping to building's interior water-distribution piping.
- B. Install shutoff valve (bronze), backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-distribution piping.

3.4 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
 - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal and install where they are not subject to freezing.
- M. Pressurize and check preaction sprinkler system piping and air compressors.

- N. Fill sprinkler system piping with water.
- O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in applicable Division 21 sections.
- P. Install sleeves and seals for piping penetrations of walls, ceilings, and floors. Comply with requirements of applicable division 21 sections.
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements in applicable Division 21 Sections.
- R. Paint all new sprinkler risers, mains and branch piping: Color Red.

3.5 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. 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.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
 - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
- E. Air Vent:
 - 1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
 - 2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.

3.7 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

3.8 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements in applicable Division 26 Sections.

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 4. Energize circuits to electrical equipment and devices.
 5. Coordinate with fire-alarm tests. Operate as required.
 6. Coordinate with fire-pump tests. Operate as required.
 7. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.11 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Standard-weight schedule 40, black-steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
1. Standard-weight, Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 2. Standard-weight, Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 3. Standard-weight, Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
1. Standard-weight, Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

2. Standard-weight, Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 3. Standard-weight, Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:
1. Standard-weight, Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 2. Standard-weight, Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.13 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
 2. Rooms with Suspended Ceilings: Recessed sprinklers.
 3. Wall Mounting: Sidewall sprinklers.
 4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 4. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.

END OF SECTION 211313

SECTION 211316 - DRY-PIPE PREACTION SPRINKLER 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. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Specialty valves.
 - 3. Sprinkler specialty pipe fittings.
 - 4. Air compressors.
 - 5. Sprinklers.
 - 6. Alarm devices.
 - 7. Manual control stations.
 - 8. Control panels.
 - 9. Pressure gauges.

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For dry-pipe sprinkler systems.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Domestic water piping.
 - 2. Compressed air piping.
 - 3. HVAC hydronic piping.
 - 4. Ductwork
 - 5. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
- B. Qualification Data: For qualified Installer and professional engineer.
- C. Design Data:
 - 1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations.
- D. Fire-hydrant flow test report.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For dry-pipe, preaction sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 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. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

1.9 FIELD CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
 1. Notify Owner no fewer than seven days in advance of proposed interruption of sprinkler service.
 2. Do not proceed with interruption of sprinkler service without Owner's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

- A. Parking Garage Double-Interlock Preaction Sprinkler System.

2.2 PERFORMANCE REQUIREMENTS

- 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. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13.
- C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- D. Delegated Design: Engage a qualified professional engineer, to design dry-pipe double interlock preaction sprinkler systems.
- E. Sprinkler system design shall be approved by authorities having jurisdiction.
 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 2. Sprinkler Occupancy Hazard Classifications per NFPA 13:
 - a. Automobile Parking Areas: Ordinary Hazard, Group 1.
 - b. Building Service Areas: Ordinary Hazard, Group 1.
 - c. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - d. Traction Elevator Machine Room and Hoistway: Ordinary Hazard, Group 1.
 - e. General Storage Areas: Ordinary Hazard, Group 1.
 - f. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.

2.3 STEEL PIPE AND FITTINGS

- A. Standard-Weight, Schedule 40, black-Steel Pipe: ASTM A53/A53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method. Furnish with antimicrobial coating (MIC-GUARD) on the inner wall of the pipe.
- B. Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
- C. Uncoated-Steel Couplings: ASTM A865/A865M, threaded.
- D. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
 - 1. Pipe-Flange Gasket Materials: EPDM rubber gasket.
 - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
 - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
 - 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- E. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
 - 1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- F. Malleable- or Ductile-Iron Unions: UL 860.
- G. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Wheatland Tube, A division of Zekelman Industries.
 - b. Victaulic Company.
 - c. Anvil International.
 - d. CPS Products, Inc.
 - e. Grinnell Supply Sales Company.
 - 2. Pressure Rating: 175-psig minimum.
 - 3. Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Pre-Action Valves:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc. (The).
 - c. Victaulic Company.
 - d. Viking Corporation.
 2. Standard: UL 260.
 3. Design: Quick opening, Hydraulically operated, differential-pressure type.
 4. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gauges, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
 5. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gauges; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.
 6. Air Compressors:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Engineered Corrosion Solutions.
 - 2) General Air Products, Inc.
 - 3) Viking Corporation.
 - b. Standard: UL's "Fire Protection Equipment Directory" listed and FM Approved.
 - c. Air compressors shall have integrated air compressors, air tanks, control panel, and air driers designed specifically for the sprinkler industry, to provide the sprinkler system with moisture-free air to a -40 degree F dew point.
 - d. Sized for application and capable of achieving system supervisory pressure within 30 minutes in accordance with requirements of NFPA 13. Provide ASME air receiver tank as required to meet requirements on larger systems.
 - e. Each unit shall be furnished with FM Approved Air Maintenance device to support multiple pre-action zones.
 - f. Include filters, relief valves, coolers, automatic drains, and gauges.

G. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175-psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

2.5 SPRINKLER PIPING SPECIALTIES

A. General Requirements for Dry-Pipe System Fittings: UL listed for dry-pipe service.

B. Branch Outlet Fittings:

1. Standard: UL 213.
2. Pressure Rating: 175-psig minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Flow Detection and Test Assemblies:

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

D. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175-psig minimum.
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

E. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

F. Adjustable Drop Nipples:

1. Standard: UL 1474.
2. Pressure Rating: 250-psig minimum.
3. Body Material: Steel pipe with EPDM O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

G. Air pressure switches: Air pressure indicators for the presaction system shall be ul listed and FM approved for the application in which it is utilized.

H. Water flow indicators: Flow indicators for preaction system shall be UL listed and FM approved for the application in which it is utilized.

I. Valve monitor switches: Monitor switches for butterfly valves shall be integral with the valve.

J. Provide lock and chain for each inspector's test valve for security.

2.6 SPRINKLERS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes: Chrome plated.

E. Sprinkler Guards:

1. Standard: UL 199.
2. Type: Wire cage with fastening device for attaching to sprinkler.
3. Install as required per NFPA requirements.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Standard: UL 753.
2. Type: Mechanically operated, with Pelton wheel.
3. Alarm Gong: Cast aluminum with red-enamel factory finish.
4. Size: 10-inch diameter.

5. Components: Shaft length, bearings, and sleeve to suit wall construction.
6. Inlet: NPS 3/4.
7. Outlet: NPS 1 drain connection.

C. Electrically Operated Alarm Notification Appliances:

1. Electric Bell:

- a. Standard: UL 464.
- b. Type: Vibrating, metal alarm bell.
- c. Size: 8-inch minimum diameter.
- d. Voltage: 120 V ac, 60 Hz, 1 phase.
- e. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.

2. Strobe/Horn:

- a. Standard: UL 464.
- b. Tone: Selectable, steady, Temporal-3 (T-3) in accordance with ISO 8201 and ANSI/ASA S3.41, 2400 Hz, electromechanical, broadband.
- c. Voltage: 120 V ac, 60 Hz.
- d. Effective Intensity: 110 cd.
- e. Finish: Red, suitable for outdoor use with approved and listed weatherproof backbox. White letters on housing identifying device as for "Fire."
- f. Sign, Integrated: Mount between backbox and strobe/horn with text visible on both sides, above and below strobe/horn. Housing to be shaped to cover surface-mounted weatherproof backbox. Sign is to consist of white lettering on red plastic identifying it as a "Sprinkler Fire Alarm" and instructing viewers to call 911, police, or fire department.

D. Pressure Switches - Water-Flow Alarm Detection:

1. Standard: UL 346.
2. Type: Electrically supervised, pressure-activated water-flow switch.
3. Components: Two single-pole, double-throw switches.
4. Design Operation: Rising pressure to 6 psi, plus or minus 2 psi signals water flow.
5. Adjustability: Each switch is to be independently adjustable.
6. Wire Separation: Pressure switch to provide separation of wiring to each switch connection to allow for low and high voltage connections to comply with NFPA 70 Article 760 requirements.

E. Pressure Switches - Low/High Air Pressure Supervisory:

1. Standard: UL 346.
2. Type: Electrically supervised pressure supervisory switch.
3. Components: Two single-pole, double-throw switches.
4. Design Operation: Detects increase and/or decrease from normal supervisory air pressure.
5. Adjustability: Each switch is to be independently adjustable.
6. Wire Separation: Pressure switch shall provide for separation of wiring to each switch connection to allow for low and high voltage connections to comply with NFPA 70 Article 760 requirements.

F. Valve Supervisory Switches:

1. General Requirements for Valve Supervisory Switches:

- a. Standard: UL 346.
- b. Type: Electrically supervised.
- c. Design: Signals that controlled valve is in other than fully open position.
- d. Wire Terminal Designations: Indicates normal switch position when switch is properly installed on the valve and valve is fully open.

2. Requirements for OS&Y Valve Supervisory Switches:

- a. Components: One or two single-pole, double-throw switches.
- b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
- c. Visual Switch Indication: Indicates device is properly installed and OS&Y valve is fully open.
- d. Mounting Hardware: Mounting bracket to grip valve yoke and prevent movement of switch assembly on OS&Y valve.
- e. Trip Rod Length: Adjustable.

3. Requirements for PIV and Butterfly Valve Supervisory Switches:

- a. Components: Two single-pole, double-throw switches.
- b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
- c. Mounting Hardware: Removable nipple.
- d. Trip Rod Length: Adjustable.

4. Requirements for Ball Valve Supervisory Switch:

- a. Components: One single-pole, double-throw switch.
- b. NEMA Rating: NEMA 4 enclosure suitable for mounting in any position indoors or outdoors.
- c. Mounting Hardware: Suitable for mounting directly to pipe, ball valves or backflow preventers sized from up to NPS 2.

2.8 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.

- 1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
- 2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
- 3. 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. Panels Components:

1. Power supply.
2. Battery charger.
3. Standby batteries.
4. Field-wiring terminal strip.
5. Electrically supervised solenoid valves and polarized fire-alarm bell.
6. Lamp test facility.
7. Single-pole, double-throw auxiliary alarm contacts.
8. Rectifier.

2.9 PRESSURE GAUGES

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gauge Range: 0- to 250-psig minimum.
- D. Label: Include "WATER" or "AIR/WATER" label on dial face.
- E. Air System Piping Gauge: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 WATER-SUPPLY CONNECTIONS

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements in applicable Division 21 & 22 Sections.
- B. Install shutoff valve, pressure gauge, drain, and other accessories indicated at connection to water-distribution piping.
- C. Install shutoff valve, check valve, pressure gauge, and drain at connection to water supply.

3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage. Minimum slope of all piping shall be per NFPA 13.
- H. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.
- I. Connect air compressor to the following piping and wiring:
1. Pressure gauges and controls.
 2. Electrical power system.
 3. Fire-alarm devices, including low-pressure alarm.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13.
- L. Drain dry-pipe sprinkler piping. Slope all piping in accordance with NFPA 13.
- M. Pressurize and check dry-pipe sprinkler system piping and air compressors.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements in applicable Division 21 Sections.
- O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements in applicable Division 21 Sections.
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements in applicable Division 21 Sections.
- Q. Paint all new sprinkler risers, mains and branch piping: Color Red.

3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. 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.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. Install valves in vertical position for proper direction of flow, in main supply to system.

2. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
 - a. Air maintenance devices: Install air pressure maintenance device with shutoff valves to permit servicing without shutting down the sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60 psig adjustable range; and 175-psig maximum inlet pressure.

3.6 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install sprinklers with water supply from heated space. Do not install pendent or sidewall sprinklers in areas subject to freezing.

3.7 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements in applicable Division 26 Sections.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 4. Energize circuits to electrical equipment and devices.
 5. Start and run air compressors.
 6. Coordinate with fire-alarm tests. Operate as required.
 7. Coordinate with fire-pump tests. Operate as required.
 8. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.11 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Schedule 40 Black-Steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
 - 1. Standard-weight, Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - 2. Standard-weight, Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 3. Standard-weight, Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- C. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
 - 1. Standard-weight, Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - 2. Standard-weight, Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 3. Standard-weight, Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- D. Standard-pressure, dry-pipe sprinkler system, NPS 5 and larger, shall be one of the following:
 - 1. Standard-weight, Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 2. Standard-weight, Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.12 SPRINKLER SCHEDULE AND SPRINKLER HEAD GUARDS

- A. Use sprinkler types in subparagraphs below for the following applications:

1. Spaces Subject to Freezing: Upright, dry pendent sprinklers; and dry sidewall sprinklers as indicated.
 2. Special Applications: Extended-coverage and quick-response sprinklers where indicated.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
 3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 4. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
- C. Sprinklers subject to mechanical injury shall be protected with listed guards per NFPA 13.

END OF SECTION 211316

SECTION 213113 - ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

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. Horizontally mounted, single-stage, split-case fire pumps.
 - 2. Fire-pump accessories and specialties.
 - 3. Pre-manufactured fire pump enclosure.
 - 4. Flowmeter systems.
 - 5. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 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. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of fire pump, from manufacturer.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire pumps to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Comply with NFPA 20.
- B. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.
- C. 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.

2.2 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS

- A. Description: Factory-assembled and -tested fire-pump and driver unit.
- B. Base: Fabricated and attached to fire-pump and driver unit, with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
- C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

2.3 HORIZONTALLY MOUNTED, SPLIT-CASE FIRE PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Patterson Pump Company; a Gorman-Rupp company.
 - 2. Peerless Pump Company.
 - 3. Pentair Pump Group.
 - 4. Apex Pumping Equipment
 - 5. Aurora Pumps
- B. Pump:
 - 1. Standard: UL 448, for split-case pumps for fire service.
 - 2. Casing: Axially split case, cast iron, with ASME B16.1 pipe-flange connections.
 - 3. Impeller: Double suction, cast bronze, statically and dynamically balanced, and keyed to shaft.
 - 4. Wear Rings: Replaceable bronze.
 - 5. Shaft and Sleeve: Alloy steel shaft with bronze sleeve.
 - a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.

- b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 - 6. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.
- C. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.
- D. Driver:
 - 1. Standard: UL 1004A.
 - 2. Type: Electric motor; NEMA MG 1, polyphase Design B.
- E. Capacities and Characteristics:
 - 1. Rated Capacity: 1250 gpm.
 - 2. Total Rated Head: 155 psig.
 - 3. Inlet Flange: Class 250.
 - 4. Outlet Flange: Class 250.
 - 5. Suction Head Available at Pump: 50 psi.
 - 6. Motor Horsepower: 200 hp.
 - 7. Starter: Wye-delta
 - 8. Motor Speed: 3600 rpm.
 - 9. Electrical Characteristics:
 - a. Volts: 460 V.
 - b. Phase: Three.
 - c. Hertz: 60.
 - 10. Rotation: To be coordinated in field.

2.4 FIRE-PUMP ACCESSORIES AND SPECIALTIES

- A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.
- B. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.
- C. Relief Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BERMAD Control Valves.
 - b. WATTS.
 - c. Zurn Industries, LLC.
 - 2. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.
- D. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.

- E. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.
- F. Hose Valve Manifold Assembly:
 - 1. Standard: Comply with requirements in NFPA 20.
 - 2. Header Pipe: ASTM A53/A53M, Schedule 40, galvanized steel, with ends threaded according to ASME B1.20.1.
 - 3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
 - 4. Automatic Drain Valve: UL 1726.
 - 5. Manifold, Flush-Type Body:
 - a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
 - b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
 - c. Nipples: ASTM A53/A53M, Schedule 40, galvanized-steel pipe, with ends threaded according to ASME B1.20.1.
 - d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
 - e. Escutcheon Plate: Brass or bronze; rectangular.
 - 6. Manifold, Exposed-Type Body:
 - a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
 - b. Body: Exposed type, brass, with number of outlets required by NFPA 20.
 - c. Escutcheon Plate: Brass or bronze; round.
- G. FLOWMETER SYSTEM
 - 1. Products shall be as manufactured by one of the following:
 - a. Hydro Flow Products, Inc.
 - b. Rosemount Inc.
 - c. Victaulic Company.
 - 2. Description: UL-Listed or FM-Approved, fire-pump flowmeter system to indicate flow to not less than 175 percent of fire-pump rated capacity.
 - 3. Pressure rating: 250 PSIG.
 - 4. Sensor: Annubar probe, orifice plate, or venturi. Sensor size shall match pipe, tubing, flowmeter and fittings.
 - 5. Permanently mounted Flowmeter; Compatible with flow sensor; with dial not less than 4.5" in diameter. Include bracket or device for wall mounting.
 - a. Tubing package: NPS 1/4 soft copper tubing with copper or brass fittings and valves.
 - 6. Included in design for fire pump testing purposes as requested by the owner.

2.5 GROUT

- A. Standard: ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink and recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.6 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
 - 1. Verification of Performance: Rate fire pumps according to UL 448.
- B. Fire pumps will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

2.7 FACTORY BUILT FIRE PUMP HOUSE (COURTHOUSE FIRE PUMP ONLY)

- A. Products shall be as manufactured by one of the following:
 - 1. APEX Pumping Equipment
 - 2. Peerless Engineered Systems
 - 3. Aurora Pumps
- B. Install new fire pump complete with pre-fabricated, factory engineered and tested, fire pump house to be located on new slab. Bolt down to new concrete footing and slab assembly to secure pre-fabricated fire pump house.
- C. The fire pump house shall be complete with but not limited to: steel beam support frame suitable for placement by crane lift; steel frame openings suitable for incoming suction and discharge piping and floor drain piping; UL listed/FM approved fire pump; jockey pump; insulation meeting the International Energy Conservation Code; electric unit heater; single point power connection; UL listed/FM approved fire pump controller and transfer switch; pre-piped (schedule 40 piping) meeting NFPA requirements; test flow meter bypass; signs and tags; test connection; double-door; LED lighting (interior and exterior); exhaust fan and associated ductwork and exterior drainable louvers and automatic air dampers; sprinkler piping and sprinkler heads; convenience outlets (interior and exterior) and sprinkler piping air vents at all high points.
- D. The fire pump house walls, roof shall be insulated and 2-hr fire rated.
- E. Enclosure and equipment shall be ETL third party certified before shipment meeting all NEC, NFPA guidelines and International Building Codes.

- F. Seismically designed structure and supports.
- G. Contractor shall coordinate final fire pump performance requirements (based on the hydraulic calculations) and pipe connection locations with the factory built fire pump house manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of fire pumps.
- B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
- B. Equipment Mounting:
 - 1. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 - 2. Comply with requirements for vibration isolation devices specified in applicable Division 21 Sections.
- C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
- D. Support piping and pumps separately, so weight of piping does not rest on pumps.
- E. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in applicable Division 21 Sections.
- F. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in applicable Division 21 Sections.
- G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
- H. Install flowmeters and sensors. Install flowmeter system components and make connections according to NFPA 20 and manufacturer's written instructions.

- I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
- J. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.3 ALIGNMENT

- A. Align split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
- B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
- C. Align piping connections.
- D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

3.4 CONNECTIONS

- A. Comply with requirements for piping and valves specified in applicable Division 21 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps and equipment to allow service and maintenance.
- C. Connect flowmeter system meters, sensors and valves to tubing.
- D. Connect relief-valve discharge to drainage piping or point of discharge.
- E. Connect fire pumps to their controllers.

3.5 IDENTIFICATION

- A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

- A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in applicable Division 26 Sections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

- C. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.7 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to provide four (4) hours of training for Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 213113

SECTION 213115 - CONTROLLERS FOR FIRE-PUMP DRIVERS

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. Full-service, reduced-voltage controllers rated 600 V and less.
 - 2. Controllers for pressure-maintenance pumps.

1.3 DEFINITIONS

- A. ATS: Automatic transfer switch.
- B. ECM: Electronic control module.
- C. MCCB: Molded-case circuit breaker.
- D. NO: Normally open.
- E. PID: Proportional integral derivative.
- F. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each type of product indicated.
 - 1. Include plans, elevations, sections, and attachment details.
 - 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. Show tabulations of the following:
 - a. Each installed unit's type and details.
 - b. Enclosure types and details for types other than NEMA 250, Type 2.
 - c. Factory-installed devices.

- d. Nameplate legends.
 - e. Short-circuit current (withstand) rating of integrated unit.
 - f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.
 - g. Specified modifications.
4. Include diagrams for power, signal, alarm, control wiring, and pressure-sensing tubing.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Certificates: For each type of product indicated, from manufacturer.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product indicated to include in emergency, operation, and maintenance manuals. In addition to items specified in applicable Division 01 Sections include the following:
 - 1. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
 - 2. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor-based logic controls.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of an NRTL.
- B. Source Limitations: Obtain fire-pump controllers and all associated equipment from single source or producer.

1.8 FIELD CONDITIONS

- A. Environmental Limitations:
 - 1. Ambient Temperature Rating: Not less than 40 deg F and not exceeding 122 deg F unless otherwise indicated.
 - 2. Altitude Rating: Not exceeding 6600 feet unless otherwise indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 20 and NFPA 70.
- B. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in applicable Division 21 Sections.
- C. 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.

2.2 FULL-SERVICE CONTROLLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASCO Power Technologies, LP; a business of Emerson Network Power.
 - 2. Eaton.
 - 3. Joslyn Clark Corporation.
- B. General Requirements for Full-Service Controllers:
 - 1. Comply with NFPA 20 and UL 218.
 - 2. Combined automatic and nonautomatic operation.
 - 3. Factory assembled, wired, and tested; continuous-duty rated.
 - 4. Provide wall mounted controller.
- C. Method of Starting:
 - 1. Pressure-switch actuated.
 - a. Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.
 - b. System pressure recorder, electric ac driven, with spring backup.
 - c. Programmable minimum-run-time relay to prevent short cycling.
 - d. Programmable timer for weekly tests.
 - 2. Magnetic Controller: Wye-delta (closed transition) type.
 - 3. Emergency Start: Mechanically operated start handle that closes and retains the motor RUN contactor independent of all electric or pressure actuators.
- D. Method of Stopping: Nonautomatic.
- E. Capacity: Rated for fire-pump-driver horsepower and short-circuit-current (withstand) rating equal to or greater than short-circuit current available at controller location.

- F. Method of Isolation and Overcurrent Protection: Interlocked isolating switch and nonthermal MCCB; with a common, externally mounted operating handle, and providing locked-rotor protection.
- G. Door-Mounted Operator Interface and Controls:
 - 1. Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
 - 2. Method of Control and Indication:
 - a. Microprocessor-based logic controller, with multiline digital readout.
 - 3. Local Alarm and Status Indications:
 - a. Controller power on.
 - b. Motor running condition.
 - c. Loss-of-line power.
 - d. Line-power phase reversal.
 - e. Line-power single-phase condition.
 - 4. Audible alarm, with silence push button.
 - 5. Nonautomatic START and STOP push buttons or switches.
- H. Optional Features:
 - 1. Extra Output Contacts:
 - a. NO contact for motor running condition.
 - b. One set of contacts for loss-of-line power.
 - c. One each, Form C contacts for high and low reservoir level.
 - 2. Local alarm bell.
 - 3. Door-mounted thermal or impact printer for alarm and status logs.
 - 4. Operator Interface Communications Ports: USB, Ethernet, and RS485.
- I. Automatic Transfer Switch (ATS):
 - 1. Complies with NFPA 20 and UL 1008
 - 2. Integral with controller as a listed combination fire-pump controller and power transfer switch.
 - 3. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure.
 - 4. Allows manual transfer from one source to the other.
 - 5. Alternate-Source Isolating and Disconnecting Means: Mechanically interlocked isolation switch and circuit breaker rated at a minimum of 115 percent of rated motor full-load current, with an externally mounted operating handle; circuit breaker shall be provided with nonthermal sensing, instantaneous-only short-circuit overcurrent protection to comply with available fault currents.
 - 6. Local Alarm and Status Indications:
 - a. Normal source available.

- b. Alternate source available.
 - c. In normal position.
 - d. In alternate position.
 - e. Isolating means open.
- 7. Audible alarm, with silence push button.
 - 8. Nonautomatic (manual, nonelectric) means of transfer.
 - 9. Engine test push button.
 - 10. Start generator output contacts.
 - 11. Timer for weekly generator tests.

2.3 CONTROLLERS FOR PRESSURE-MAINTENANCE PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASCO Power Technologies, LP; a business of Emerson Network Power.
 - 2. Eaton.
 - 3. Joslyn Clark Corporation.
- B. General Requirements for Pressure-Maintenance-Pump Controllers:
 - 1. Type: UL 508, factory-assembled, -wired, and -tested, across-the-line controller; for combined automatic and manual operation.
 - 2. Enclosure: UL 508 and NEMA 250, Type 2 for wall-mounting.
 - 3. Factory assembled, wired, and tested.
 - 4. Finish: Manufacturer's standard color paint.
- C. Rate controller for scheduled horsepower and include the following:
 - 1. Fusible disconnect switch.
 - 2. Pressure switch.
 - 3. Hand-off-auto selector switch.
 - 4. Pilot light.
 - 5. Running period timer.

2.4 ENCLOSURES

- A. Fire-Pump Controllers and ATS: NEMA 250, to comply with environmental conditions at installed locations and NFPA 20.
 - 1. Other Wet or Damp, Indoor Locations: Type 4 (IEC IP56).
- B. Enclosure Color: Manufacturer's standard "fire-pump-controller red."
- C. Nameplates: Comply with NFPA 20; complete with capacity, characteristics, approvals, listings, and other pertinent data.

2.5 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect fire-pump controllers according to requirements in NFPA 20, NFPA 25 and UL 218.
 - 1. Verification of Performance: Rate controllers according to operation of functions and features specified.
- B. Fire-pump controllers will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive equipment, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine equipment before installation. Reject equipment that is wet or damaged by moisture or mold.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONTROLLER INSTALLATION

- A. Coordinate installation of controllers with other construction including conduit, piping, fire-pump equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels. Ensure that controllers are within sight of fire-pump drivers.
- B. Install controllers within sight of their respective drivers.
- C. Connect controllers to their dedicated pressure-sensing lines.
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Comply with NEMA ICS 15.

3.3 IDENTIFICATION

- A. Comply with requirements in NFPA 20 for marking fire-pump controllers.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification in NFPA 20, NFPA 70E and as specified in applicable Division 21 Sections.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
- D. Acceptance Testing Preparation:
 - 1. Inspect and Test Each Component:
 - a. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
 - 2. Verify and Test Each Electric-Drive Controller:
 - a. Verify that voltages at controller locations are within plus 10 or minus 1 percent of motor nameplate rated voltages, with motors off. If outside this range for any motor, notify Architect before starting the motor(s).
 - b. Test each motor for proper phase rotation.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Field Acceptance Tests:
 - 1. Do not begin field acceptance testing until suction piping has been flushed and hydrostatically tested and the certificate for flushing and testing has been submitted to Architect and authorities having jurisdiction.
 - 2. Prior to starting, notify authorities having jurisdiction of the time and place of the acceptance testing.
 - 3. Engage manufacturer's factory-authorized service representative to be present during the testing.
 - 4. Perform field acceptance tests as outlined in NFPA 20.
- F. Controllers will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks, according to manufacturer's written instructions.

3.6 ADJUSTING

- A. Adjust controllers to function smoothly and as recommended by manufacturer.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, and timers.
- C. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- D. Set field-adjustable pressure switches.

3.7 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
- B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controllers, and to use and reprogram microprocessor-based controls within this equipment.

END OF SECTION 213115

SECTION 213413 - PRESSURE-MAINTENANCE JOCKEY PUMPS

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. Vertical, multistage, pressure-maintenance pumps.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For pumps, accessories, and specialties.
 - 1. Include plans, elevations, sections, and attachment details.
 - 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. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pumps to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 VERTICAL, MULTISTAGE, PRESSURE-MAINTENANCE PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pentair.
 - 2. PACO Pumps; Grundfos Pumps Corporation, USA.
 - 3. Taco Comfort Solutions.
- B. Description: Factory-assembled and -tested, multistage, barrel-type vertical pump as defined in HI 2.1-2.2 and HI 2.3; designed for surface installation with pump and motor direct coupled and mounted vertically.
- C. Pump Construction:
 - 1. Barrel: Stainless steel.
 - 2. Suction and Discharge Chamber: Cast iron with flanged inlet and outlet.
 - 3. Pump Head/Motor Mount: Cast iron.
 - 4. Impellers: Stainless steel, balanced, and keyed to shaft.
 - 5. Pump Shaft: Stainless steel.
 - 6. Seal: Mechanical type with carbon rotating face and silicon-carbide stationary seat.
 - 7. Wear Rings: Teflon.
 - 8. Intermediate Chamber Bearings: Aluminum-oxide ceramic or bronze.
 - 9. Chamber-Base Bearing: Tungsten carbide.
 - 10. O-Rings: EPDM.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Motor: Single speed with permanently lubricated ball bearings and rigidly mounted to pump head. Comply with requirements in Section 210513 "Common Motor Requirements for Fire Suppression Equipment."
- F. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet long.
- G. Nameplate: Permanently attached to pump and indicating capacity and characteristics.
- H. Capacities and Characteristics:
 - 1. Rated Capacity: 15 gpm.
 - 2. Total Dynamic Head: 155 psig.
 - 3. Working Pressure: 175 psig minimum.
 - 4. Inlet and Outlet Size: NPS 1-1/4.
 - 5. Discharge and Suction Flanges: Class 250.
 - 6. Suction Head Available at Pump: 50 psig.
 - 7. Motor Horsepower: 3.
 - 8. Motor Speed: 3500 rpm.

9. Electrical Characteristics:

- a. Volts: 460.
- b. Phases: Three.
- c. Hertz: 60.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in applicable Division 21 Sections.

1. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. NFPA Standard: Comply with NFPA 20 for installation of pressure-maintenance pumps.

B. Equipment Mounting:

- 1. Install multistage, pressure-maintenance pumps according to HI 1.4.
- 2. Install base-mounted pumps on cast-in-place concrete equipment base(s).
 - a. Comply with requirements for vibration isolation devices specified in applicable Division 21 Sections.
 - b. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - d. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - e. Attach pumps to equipment base using anchor bolts.
 - f. Shim pumps as needed to make them level.
- 3. Install isolation valves in both inlet and outlet pipes near the pump. Comply with requirements for valves specified in applicable division 21 sections.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Prepare test and inspection reports.

3.3 ADJUSTING

- A. Lubricate pumps as recommended by manufacturer.
- B. Set field-adjustable pressure-switch ranges as indicated.

END OF SECTION 213413

SECTION 220010 - GENERAL REQUIREMENTS PLUMBING

PART 1 - GENERAL REQUIREMENTS PLUMBING

1.1 GENERAL

- A. The conditions of Divisions 00 and 01 apply to each and every Trade Contractor or other person or persons supplying any material or labor entering this building and/or site, either directly or indirectly. In the event of a conflict between Section 220010 and Divisions 00 and 01, the terms of Divisions 00 and 01 shall govern.
- B. One Building Trade, the Plumbing Building Trade, will be covered by these General Requirements Plumbing.
- C. For simplicity, this Building Trade will be referred to further herein as the Plumbing Trade Contractor. The Plumbing Specifications and all Plumbing Drawings, together with all addenda make-up the Plumbing Contract Documents, and are a part of the "Project Contract Documents", as described throughout these specifications.
- D. The term "Electrical Trade" as used in the Contract Documents, means the Electrical Building Trade.
- E. The term "indicated" means all information included, detailed, shown and/or implied on the Contract Documents.
- F. The term "existing" is used generally in reference to renovation projects. On new construction projects, the term "existing" is intended to mean work already in place.

1.2 INTENT OF THE PLUMBING CONTRACT DOCUMENT

- A. The intent of the Plumbing Contract Documents is to include all items and labor necessary for the proper execution and completion of the Work of the Plumbing Trade Contractor. The Contract Documents of all Trades are complimentary to each other; what is required by one shall be as binding as if required by all. Performance of the Plumbing Trade Contractor is required only to the extent consistent with the Project Contract Documents and reasonably inferable from them as being necessary to produce the desired results.
- B. It is expressly stipulated that neither the Drawings nor the Specifications shall take precedence over the other, and it is further stipulated that the Architect/Engineer may interpret or construe the Drawings and Specifications so as to secure in all cases the result most consistent with the needs and requirements of the work. In the event of such ambiguity or discrepancy, comply with the higher cost product (material plus labor), the more stringent requirement, and supply the better quality or greater quantity of work.

1.3 PROPOSAL PREPARATION

- A. Prior to submitting a pricing quotation/proposal, proceed as follows, and include the following:

1. Visit the site, survey, record, confirm and include in the scope of work, all material and labor necessary to install the equipment and systems indicated. Use the Contract Documents as diagrammatic in nature, since they are not intended to show all details which may affect the plumbing bid proposal.
2. Include the work, as applicable, to remove and dispose of plumbing fixtures, piping, insulation, equipment and appurtenances, not required for new work, unless otherwise indicated to be abandoned in place.
3. Include all disconnections, removals and temporary provisions required to permit rigging, installation, connection, testing and operation of the new equipment. Include all such provisions whether or not shown, detailed or specified within technical sections of the Contract Documents.
4. Include in the work, providing the labor of Keymen, including, but not limited to the following:
 - a. One Project Manager;
 - b. One Project Foreman.
- 1) Plumbing Contractor shall prepare all equipment arrangements and layout drawings, and initiate coordination drawings.
5. Foreman must refine the detail, layout, coordination and fit of all of the plumbing equipment. Plan all disconnections, removals, offsets, temporary provisions, as required, to fit the new equipment into the space, and as required to accommodate maintenance accessibility and service access.
6. Project Manager must maintain and submit for approval, a written project schedule, on a weekly basis.
7. All Project Manager must organize, administrate, control and log the RFI process for their respective trade. Where applicable, submit all RFI(s) for master RFI log maintained by Lead/Prime Contractor.

B. In preparing a Bid Price:

1. Thoroughly review and confirm all existing conditions and Contract Document information. Make note in writing of any exceptions, misunderstandings, unclear areas, unclear directions, and any aspects which will prohibit completion of the work, in total. Failing to supply such notice, all bidders will be accountable for having accepted all conditions at the site which affect their work and their costs. By submitting a bid price, all Trade Contractors certify that the Contract Documents have been thoroughly reviewed and are sufficient for construction, and that the bidding Trade Contractors have adequate information to establish and determine their responsibility for materials, methods, costs, and schedule for their work.
2. Incorporate all requirements of all sections of the Contract Documents.
3. Include the following with the Manufacturer's and Sub-Contractor's Lists:
 - a. The name and telephone number of all Sub-Contractors.

1.4 HAZARDOUS MATERIALS

- A. The use of asbestos, PCB's or any material or product containing hazardous materials in the performance of this contract is not permitted. Certify, in writing, that no hazardous material or product containing a hazardous material, has been furnished or installed.

1.5 DRAWINGS AND SPECIFICATIONS

- A. It is the intent of the specifications and drawings to include under each item all materials, apparatus and labor 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 properly operating whole.
- B. Any apparatus, machinery, small items not mentioned in detail which are necessary to complete or perfect any portion of the installation in a substantial manner and in compliance with the requirements stated, implied or intended must be furnished and/or installed without extra cost to the Project. This includes all materials, devices or methods peculiar to the machinery, apparatus or systems furnished and/or installed by the Plumbing Trade Contractor.
- C. In referring to drawings, figured dimensions take precedence over scale measurements. Verify all wall locations, ceiling heights, elevations, dimensions, etc. on the architectural drawings, where applicable. Discrepancies must be referred to the Engineer for decision. Certify and verify all dimensions, routings and layouts in the field and on the coordination drawings before ordering material or commencing work.
- D. Any work called for in the specifications, but not mentioned or shown on the drawings, or called for on the drawings, but not mentioned in the specifications, must be furnished and/or installed as though called for in both.
- E. When any device or part of equipment is herein referred to in the singular number, such as "the pump" such reference is deemed to apply to as many such devices as required to complete the installation.
- F. The term "Provide" means "Furnish and Install". Neither term will be used generally in these specifications, but will be assumed. The term "Furnish" means to obtain and deliver to the job site for installation by other trades.

1.6 LAWS, ORDINANCES, REGULATIONS AND PERMITS

- A. The entire plumbing system in all and/or in part must conform to all pertinent laws, ordinances and regulations of all bodies having jurisdiction, notwithstanding anything in these drawings or specifications to the contrary.
- B. Pay all fees and obtain and pay for all permits and inspections required by any authority having jurisdiction in connection with the work under this contract.
- C. Electrical work performed by the Plumbing Trade Contractor must comply with the requirements of the National Electrical Code, NFPA and other boards and departments having local jurisdiction.

1.7 CONNECTIONS TO UTILITIES

- A. Apply for and obtain services from Utility Companies and municipalities. All charges for which Utility Companies and municipalities must be reimbursed must be paid for by the Plumbing Trade Contractor at no additional cost to the Project.

1.8 TESTS

- A. The following requirements are supplementary to tests specified for individual equipment or systems in other specification sections. Give written notice of date of test in ample time to all concerned.
- B. Concealed or insulated work must remain uncovered until all required tests have been completed; but if construction schedule requires, arrange for partial tests on portions of systems as approved. If a Prime Contractor covers or directs a Sub-Contractor to cover plumbing work prior to completing the required tests, the Prime Contractor is responsible for any additional costs related to completing the required tests.
- C. As soon as conditions permit, conduct preliminary tests of equipment to ascertain compliance with specified requirements. Make needed changes, adjustments and/or replacements as preliminary tests may indicate, prior to acceptance tests.
- D. Conduct pressure, performance and operating tests as specified or required for each system or piece of equipment installed, modified or affected under this contract in presence of the Engineer or Owner as well as a representative of agencies having jurisdiction.
- E. Obtain Certificates of Approval and/or Acceptance as specified or required in compliance with regulations of agencies having jurisdiction. Work will not be deemed complete until such Certificates have been delivered to the Engineer.
- F. Prove conclusively, by testing, that Plumbing systems operate properly, efficiently and quietly in accordance with intent of drawings, specifications and most widely used construction practices.

1.9 CLEANING

- A. Be responsible for the following:
 - 1. Removal of all lumber, refuse, metal, piping and debris from site resulting from plumbing work.
 - 2. Cleaning drippings created by the plumbing work, from finished work of other Trades.
 - 3. Cleaning, polishing, waxing of plumbing work as required.
- B. After testing, and acceptance of all work by the Engineer and the Owner, thoroughly clean all plumbing equipment and material to the satisfaction of the Engineer.

1.10 GUARANTEE

- A. All material, equipment and workmanship must be in first class operating condition in every respect at time of acceptance by Owner. Acceptance by the Owner will be by letter written to the Plumbing Trade Contractor.
- B. Unconditionally guarantee in writing all materials, equipment and workmanship for a period of one (1) year from date of acceptance by Owner. During the guarantee period, repair or replace, at the Plumbing Trade Contractor's expense, any materials, equipment or workmanship in which defects may develop and provide free service for all equipment and systems involved in the contract during this guarantee period. Beneficial use of any system by the any of the Trade Contractors during construction does not constitute acceptance by the Owner. Time period of this beneficial use cannot be included in the guarantee period.
- C. Guarantee must also include restoration to its original condition of all adjacent work that is disturbed in fulfilling this guarantee.
- D. All such repairs and/or replacements must be made without delay and at the convenience of the Owner.
- E. Guarantees furnished by Trade Contractors and/or equipment manufacturers must be counter-signed by the related Trade Contractor for joint and/or individual responsibility for subject item.
- F. Manufacturers' equipment guarantees or warranties extending beyond the guarantee period described in item B above must be transferred to the Owner along with the Trade Contractor's guarantees.

1.11 ENTRANCE OF EQUIPMENT

- A. Determine the method of equipment entrance during initial site visit prior to bidding. Do not scale building openings, door widths and equipment or component sizes off the drawings. Determine sizes from site measurements and equipment manufacturer. Include cost of equipment manufacturer's knockdown, use of field assembled equipment, field assembly, all work required for access, removals, replacements, general construction, and the like, as required. During preparation of submittals, verify whether knocked-down or pre-disassembled equipment have been proposed all to the extent required to permit entry of equipment to final location. Verify that the use of field assembled (not pre-assembled) equipment complies with manufacturer's warranty, guarantee, listings and requirements.
- B. Perform all necessary rigging required for completion of Plumbing work.
- C. Deliver products to the site properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification. Deliver products and equipment to the site properly weatherproofed.
- D. The Trade Contractor who furnishes or purchases the product or equipment is responsible to provide and maintain protection from the weather, dust, dirt, construction debris, etc. until the project is complete.

- E. For all products and equipment which, when installed, have an opening into the building must be provided with a plywood cover, or similar protection, to prevent debris, rain, etc. from entering the building. The Trade Contractor who installs the product or equipment is responsible for such protection beginning at the time of installation.

1.12 SERVICING OF EQUIPMENT AND SYSTEMS

- A. After work has been completed in accordance with the Contract Documents, and prior to final acceptance tests, each Trade Contractor must have manufacturers or their authorized agents of the equipment installed, completely check their equipment and put equipment into proper operation. In each case, the respective Trade Contractor must have the manufacturers thoroughly check the complete installation of the equipment, furnished by the manufacturer, for proper and correct operation under the service intended.
- B. Prior to expiration of the guarantee period, each Trade Contractor must check all equipment, materials and systems for which he is responsible, make necessary adjustments and/or replacements, and leave systems in first class operating condition.

1.13 SERVICING OF EQUIPMENT AND SYSTEMS (EXISTING/UNMODIFIED)

- A. Selected, designated existing plumbing systems and equipment are planned to be continued in service upon project turnover, with no specified repair/modification covered under the Contract Documents. The Owner reserves the right to request repair/maintenance labor and materials, as an Owner requested change, depending on the results presented in the Plumbing Trade Contractor's Evaluation Report.
- B. Perform inspection, evaluation, start-up and testing of the plumbing systems and equipment listed below or as specified in the applicable sections of Division 22, and prepare a full Plumbing Evaluation Report listing: defects; deficiencies; required maintenance/repair labor and materials, all as required to restore unmodified systems and equipment to safe reliable code compliant use:
 - 1. Parking Garage sump pumps and pits at the following locations:
 - a. Level C mechanical room adjacent to Stair G.
 - b. Level D storage room adjacent to Stair G.
- C. Include within the Plumbing Evaluation Report, a detailed breakdown of the proposed additional material and labor required to complete the recommended restoration(s).

1.14 EXCAVATION AND BACKFILLING

- A. Perform all excavation, backfilling and pumping necessary for completion of plumbing work. All excavation is considered classified.
- B. Remove from premises or deposit as directed by Engineer all material excavated and not required or suitable for backfilling.

- C. Carefully remove and store topsoil, shrubbery and sod until underground work is complete and trenches are backfilled and then re-install. Replace any damaged items to the satisfaction of the Engineer. Re-sod all excavation associated with the new exterior sanitary piping after the ground has settled. Re-sodded areas shall be level with surrounding undisturbed grass areas.
- D. Allow adequate cover over piping and conduit in trenches as applicable. Trench walls must be perpendicular to the top of piping and conduits and trench bottoms must be instrument graded in the direction of flow as required. Earth must be scooped out under pipe hubs to provide a solid bearing for the pipe, duct or conduit on undisturbed earth. Cinder fill, stones or bricks beneath piping are prohibited. Pipe, and conduits less than 6-inches in outside diameter which do not require sloping, shall have hard trench bottoms and shall be supported on undisturbed subgrade. Trench bottoms for sloping utilities, pipes, and conduits over 6-inches in outside diameter shall be excavated 6-inches deeper than elevation and a 6-inch thick tamped bedding shall be installed. Bedding shall be naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- E. Provide sheathing, shoring and bracing necessary to complete excavation and backfilling work and exercise every precaution necessary to prevent accident, injury or death to any human and damage to property of others. Remove all debris, sheathing, shoring and bracing upon completion of work.
- F. It is the responsibility of each Trade Contractor to check with the various Utility Companies and make the necessary arrangements to avoid damage to their property. Each Trade Contractor is responsible for damage during excavation to existing underground structures including, but not limited to electric, structural, piping or equipment. Such damage must be repaired promptly without cost to the Project. Do not dig until all underground utilities are identified and located.
- G. Backfill after inspection and approval. Backfill must be made with clean earth, free from rocks, frozen particles, debris or other foreign materials. Deposit in uniform layers not over six inches (6") thick with each layer mechanically tamped before the next layer is applied. When approved backfill material is not available from the site, each Trade Contractor, at no additional cost to the project, must provide additional select backfill to complete installation. Partial backfill on piping leaving all joints exposed is mandatory for all underground gas and underground domestic water systems. Final backfill only after testing procedures have been approved.
- H. All trenches that pass under wall foundations must be backfilled with lean concrete, full height, directly under wall footing, and at a 1:1 slope away from wall or column footing. Trenches that are parallel with and deeper than wall foundations must be backfilled with lean concrete on a 1:1 slope away from the bottom of the wall or column footing.
- I. Perform all cutting and patching to driveways, sidewalks, curbs, bituminous paving, walls, and the like, required by performance of excavation and backfilling. Install and maintain temporary paving as directed by Engineer. Make repairs to sidewalks in complete blocks, partial patching will not be acceptable. Provide all materials for patching in strict accordance with applicable Articles of Divisions 01 through 33 of the Contract Specifications. All patching to match adjacent construction.

- J. Where rock is encountered during installation of underground piping systems, carry trenches to a point six inches (6") below invert of pipe and provide a six inch (6") layer of crushed stone or gravel as a cushion.
- K. All excavation work must include all pumping equipment, materials and labor necessary to keep all excavations free of water. Provide well points as required with disposition of water as directed by Architect/Engineer.
- L. Provide suitable indemnity for all accidents to humans, animals or equipment caused by excavating and backfilling work. Provide suitable guards, barricades, red lanterns, flares and take the necessary precaution for an approved and safe installation. All trenches must be backfilled at the end of each working day. Where a trench must be left open, provide coverings of adequate size and strength over entire open area.
- M. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6-inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas.
 - 3. Blue: Water systems.
 - 4. Green: Sewer systems.
- N. Trade Contractors shall engage the services of a Utility Identification Sub-Contractor to identify all existing underground utilities in the path of the proposed trench excavation. It shall be the Utility Identification Sub-Contractor's sole responsibility to search, investigate, test and identify existing underground utilities such as, but not limited to the following: gas piping, water piping, steam piping, condensate piping, electrical lines, sanitary piping, storm water piping, data, telephone, fiber optics and any other utility service, piping, lines or trenches. Before excavation can begin, the Trade Contractors shall provide all utility data concerning the underground utilities to Design Professional, and Owner. Data shall be in the form of a scaled drawing of the proposed excavation with all utilities clearly indicated.

1.15 CONTINUITY OF SERVICES

- A. Generally, no actions can be taken by the Plumbing Trade Contractor that will interrupt any of the existing building services for these buildings or any other building until previously arranged and scheduled with the Engineer and Owner.
- B. Should any service be interrupted by the Plumbing Trade Contractor, immediately provide all labor, including overtime if necessary, and all material and equipment necessary for restoration of such service, at no additional cost to the Project.

1.16 SMOKE AND FIRESTOPPING (GENERAL)

- A. Furnish and install a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and to maintain the integrity of the "fire and/or smoke"

rated construction. Refer to Division 07 of these specifications. Fire and smoke rated construction is identified on the Architectural Drawings. Provide firestopping in the following locations:

1. Pipe and conduit penetrations through above grade floor slabs and through “fire and/or smoke”-rated partitions and fire walls.
 2. Penetrations of vertical shafts including, but not limited to pipe chases, duct chases, elevator shafts, and utility chutes.
 3. Other locations where indicated or required.
- B. Prepare submittals and submit for approval. Include manufacturer's descriptive data, typical details, installation instructions and the fire/smoke test data and/or report as appropriate for the time rated construction and location. The fire/smoke test data must include a certification by a nationally recognized testing authority that the material has been tested in accordance with ASTM E 814, or UL 1479 fire tests.
- C. Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, and protect from damage and exposure to elements. Damaged, deteriorated or outdated shelf life materials shall not be used and must be removed from the site.

1.17 COORDINATION DRAWINGS

- A. The Plumbing Trade Contractor must initiate preparation of coordination drawings, control original reproducibles, collect, organize and facilitate the work/input of General Construction Trade Contractor and all other building trades, as applicable, relative to the 100% final submission of the coordination drawings. Prepare coordination drawings in accordance with Division 01, to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of equipment and materials in relationship with other systems, installations, and building components. Use proposed equipment submittals, which include certified dimensions, service clearances, etc., to prepare the coordination drawings. If equipment is submitted for review after completion of the coordination drawings and rejected during the submittal review process, because the equipment fails to meet the project specifications, the Plumbing Trade Contractor is responsible to revise the coordination drawings and layout the work using equipment which meets the project specifications. Designate all specified return air plenums, locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
 - a. Clearances for installing and maintaining insulation.
 - b. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - c. Equipment connections and support details.
 - d. Exterior wall and foundation penetrations.
 - e. Fire-rated wall and floor penetrations.
 - f. Sizes and location of required concrete pads and bases.
 - g. Valve stem movement.

- h. Service clearance for equipment behind access doors.
 - i. Location of structural columns, beams and supports.
- 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
- 3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls and ceilings and their relationship to other penetrations and installations.
- 4. Prepare reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling mounted items.
- 5. The foregoing information and coordination work must be provided by the applicable Trade Contractor using the coordination drawings as initiated by the Plumbing Trade Contractor.
- 6. The Plumbing Trade Contractor must submit completed coordination drawings for record purposes, not for technical review and approval, but as proof that the coordination drawings have been completed. The coordination drawings must be completed and submitted for record in advance of submission of sheet metal shop drawings.

1.18 NATURAL GAS PIPING SUBMITTALS

- A. Sizes specified for materials such as natural gas piping, are included in the Contract Documents and intended for bidding purposes. Actual sizes required for approved system performance depend on the actual length of runs, routing, bends, offsets, fittings and elbows, planned by the Plumbing Trade Contractor during layout of the Plumbing work and must account for existing/new field conditions.
- B. Submit product data and shop drawings, as applicable to each Trade Contractor, for the gas piping. Submittals shall indicate all aspects of the work layout including: materials; length; routing; bends; offsets; fittings; elbows; and compliance with equipment manufacturer's directions (specifications, limitations, sizing tables, etc. required to meet such specifications). Attach copies of manufacturer's specifications and performance tables to required equipment submittals.
- C. Processing gas piping submittals and piping layout shop drawings: Plumbing Trade Contractor to conform to accepted standards relative to sizing, pressure drop limits, manufacturer's recommendations, NFPA, and Fuel Gas Code.
- D. Submit Manufacturer's or Trade Contractor's confirming calculations of pressure drops, and/or sizing resulting from all of the variables controlled by the Plumbing Trade Contractor during layout of the Plumbing work for review by the Engineer as part of the submittal review process.

1.19 TRADE CONTRACTOR'S CERTIFICATION

- A. Upon final completion of all work, each Trade Contractor must provide a notarized letter on Corporate letterhead, executed by a Corporate Officer, or Company Partner, stating that the work has been completed in accordance with the Contract Documents, Addenda, Bulletins, Trade Contractor's Punch List items and Architect's/Engineer's Construction Observation Report(s). Final Payment will not be approved until the notarized letter has been provided. Refer to the following sample letter.

SAMPLE LETTER

ENGINEER/ARCHITECT _____

TRADE CONTRACTOR _____

PROJECT _____ NO. _____

I hereby certify that all work under the HVAC, Plumbing, Fire Protection and Electrical Contract Documents, as applicable, including all addenda, bulletins, Punch List items and Construction Observation Reports, has been completed and the quality and workmanship of the work has been performed in accordance with Contract Documents.

State of: _____

County of: _____

Trade Contractor: _____

Subscribed and Sworn to before
me this _____ day of
20 _____

Notary Public: _____

By: _____

Date: _____

My Commission Expires: _____

(Ctrl) +

1.20 CONNECTIONS TO EXISTING SYSTEMS

- A. Work under this contract may require connections to existing domestic water systems. Include in the bid, all material and labor necessary to perform the following work:
1. Drain the system to level necessary to complete the work;
 2. Fill the system to original fill pressure while venting excess air from the system.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S AND SUB-CONTRACTORS LIST, KEYMEN RESUMES

- A. Before ordering any material or equipment unit, and not later than ten (10) working days after signing of contracts, submit a list of Manufacturers, Sub-Contractors and Suppliers showing make, type, manufacturer's name and trade designation of all materials, and equipment,

proposed for use under this contract. Prepare list by reference to specifications. Identify all long lead submittals which will require an expedited submittal review.

- B. Refer to the Article "Proposal Preparation," in this section. Specifically designate the labor force required of the Plumbing Trade Contractor. As part of the mobilization phase of the work, submit resumes for each Keyman including the Project Manager and Project Foreman.
- C. These lists, when approved, will be supplementary to specifications, and no variations therefrom will be permitted except with the approval of the Engineer.
- D. Submittals will not be processed until the requirements of this Article are satisfactorily completed.

2.2 MATERIALS AND EQUIPMENT

- A. All materials and equipment must be new and conform to the grade, quality and standards specified herein.
- B. All equipment offered under these specifications is limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature made available to the public and in effect at the time of opening of bids. Testing agency seals, decals and/or nameplate shall be attached to and visible on all equipment.
- C. Items such as valves, motors, starting equipment, vibration isolating devices, and all other equipment and material, where applicable and practicable, must each be of one manufacturer.
- D. Install equipment in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. Obtain these instructions, which will be considered part of these specifications. Type, capacity and application of equipment must be suitable and operate satisfactorily for the purpose intended in the plumbing systems.

2.3 INSERTS, HANGER SUPPORTS, CLAMPS, FASTENINGS

- A. All materials, designs and types of inserts, hanger supports and clamps must meet the requirements of the latest edition of the Manufacturers Standardization Society Document MSS-SP-58, Underwriters Laboratories, Inc., National Electrical Code and Factory Mutual Engineering Division Standards where applicable. Insert, hanger support and clamp types referenced herein are shown in MSS-SP-58.
- B. Provide all necessary inserts, hanger supports, fastenings, clamps and attachments necessary for support of the plumbing work. Select the types of all inserts, hanger supports, fastenings, clamps and attachments to suit both new and existing building construction conditions specifically for the purposes intended.
- C. Clamps and attachments to steel beams and bar joists must be made using types 20, 21, 23, 25, 27, 28, 29 or 30 as applicable to suit conditions of construction. Clamps and attachments must be selected on the basis of the required load to be supported. Provide all necessary steel angle iron or channel between bar joists, or steel beams where direct attachment cannot be made. Holes are not permitted to be drilled or burned in structural building steel for hanger rod

supports. Welding of hangers or supports to structural steel is prohibited unless approved beforehand by the Structural Engineer.

- D. Metallic masonry anchors may be provided for all pre-cast concrete, masonry and cast concrete construction as an alternate to item (C) above. Locate in pre-cast and cast-in-place concrete as directed by the Structural Engineer. Anchor Basis of Design: Dynabolt, Ram-In and/or Tru-Bolt masonry anchors as manufactured by Ramset. Select and install as recommended by the anchor manufacturer for the various applications, stresses and services involved. Comparable products by Redhead, Hilti or Wej-It may be submitted for review. Installation of masonry anchors must be accomplished by pre-drilling concrete or masonry to diameters and depths required to properly accommodate anchor bolts.
- E. Toggle bolts may be used in dry wall and lath and block plaster walls. The use of toggle bolts is restricted to the weight limitations imposed by the toggle bolt manufacturer for the size used.
- F. Except where noted otherwise herein, attachment to wood or material of similar fibrous nature must be made with lag screws and/or wood screws of required size.
- G. Screws with wooden or plastic plugs, or lead anchors are not acceptable.

2.4 EQUIPMENT ANCHOR BOLTS

- A. Provide and set in place at the time concrete foundations, bases or curbs are poured or formed, all necessary anchor bolts as required for the various equipment specified herein, with hook type anchor bolts of proper size and length to suit the apparatus as recommended by the equipment manufacturer. Set bolts in pipe sleeves of approximately twice the bolt diameter and of length equal to the embedded length of the bolt, with sleeves terminating flush with finished surfaces of foundations, bases or curbs.
- B. When the equipment is set in its proper position and aligned with the anchor bolts, the space between the anchor bolts and the inside wall of the sleeves must be completely filled with non-shrink cementitious grout. Grout Basis of Design: Crystex as manufactured by L & M Construction Chemicals, Inc. Comparable product by Master Builders or BASF may be submitted for review.
- C. When a General Construction Trade Contractor provides concrete foundations, bases or curbs, the Plumbing Trade Contractor is responsible for all anchor bolts required by the equipment he provides, under the Contract Documents. Assign a supervisory representative to be present at the time foundations, bases or curbs are poured or formed. For projects wherein there is no General Construction Trade Contractor, the Plumbing Trade Contractor is responsible for pouring, locating, and setting equipment foundations, bases and curbs and the location of anchor bolts for the equipment provided or installed by him on this Project.
- D. All anchor bolts must be of sufficient strength to withstand any loading imposed by the attached materials or equipment.

2.5 PIPING AND CONDUIT SLEEVES

- A. Provide all sleeves required for plumbing work and be fully responsible for the final and permanent locations thereof.
- B. Provide sleeves in the following locations:
 - 1. All pipes and conduits passing through all cast-in-place concrete construction and masonry walls.
 - 2. All pipes and conduits passing through cast-in-place waterproof concrete construction and waterproof masonry walls.
- C. Extend through construction and finish flush with each surface except where noted otherwise. Provide for a minimum ½" clearance around conduit, pipe or its covering in the instance of pipe covered with insulation.
- D. All sleeves in waterproof walls and floors must be fitted and sealed with positive hydrostatic mechanical seals. Provide Basis of Design Product "Link Seal" as manufactured by Thunderline Corporation or Comparable Product by Advance Products and Systems, Inc. or Proco Products, Inc. Sleeves must be sized accordingly. Mechanical seals must be placed around piping and/or conduit and inserted into void between inner wall of sleeve and piping and/or conduit. Tighten mechanical seals as required for watertight seal.
- E. All sleeves must be Schedule 40 steel pipe finished with smooth edges. Sleeves in waterproof walls and floors must be fabricated with minimum 1/4" thick rectangular steel plate placed around mid-point of sleeve, continuously welded to sleeve and then place the entire/plate assembly into proper position prior to erection of walls and floors. Otherwise, provide sleeves with a minimum of three (3) lugs for anchoring.
- F. Pack voids between sleeves, piping or conduit, where located in fire or smoke rated assemblies, in accordance with UL Fire Resistance Directory.
- G. Set all sleeves prior to or during erection of walls and floors. In the event that sleeves are omitted or incorrectly located in new walls or slabs, submit a location plan and method of cutting and installing sleeves to the Engineer for review prior to carrying out the work.
- H. If sleeves are omitted or located incorrectly, the particular Trade Contractor who is at fault, at no additional cost to the project, must engage the trade which originally installed the work, to cut and patch to the satisfaction of the Engineer.
- I. Provide mechanical seals and insert into voids between piping and conduits that pass through floors, and which will be exposed in finished areas that have floor drains, including spaces classified as "Janitors Closets," "Toilet Rooms," and the like.
- J. Where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut through concrete and masonry using a cutting machine, such as a masonry saw or core drill, to insure a neat hole.

2.6 SMOKE/FIRESTOPPING (MATERIALS)

- A. Firestopping materials and systems must consist of commercially manufactured products complying with the following minimum requirements and be asbestos and PCB free:
 - 1. Flame Spread Index: Twenty-five or less when tested in accordance with ASTM E 84.
 - 2. Smoke Density Index: Fifty or less when tested in accordance with ASTM E 84.
 - 3. Nontoxicity: Nontoxic to human beings at all stages of application and during fire conditions.
 - 4. Systems shall comply with Underwriter's Laboratory Listing Requirements.
 - 5. Fire Resistance:
 - a. Materials and systems used to seal penetrations in time rated assemblies must be capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 time temperature fire conditions for 3 hours.
 - b. Materials must not require a rise in temperature to install or activate seal.
 - c. Materials must not contain solvents or require hazardous waste disposal.
 - d. Firestop material must not dissolve in water after curing.
- B. Basis of Design for smoke and firestopping material is Rectorshield, Inc. Comparable product by Hilti, or 3M may be submitted for review.
- C. Smoke stopping materials must be approved by the authority having jurisdiction.

PART 3 - EXECUTION

3.1 METHOD OF PROCEDURE

- A. The drawings accompanying these specifications are diagrammatic and intended to cover the approximate and relative locations of the building systems.
- B. Installation, connection and interconnection of all components of these systems must be complete and made in accordance with the manufacturers' instructions and best trade practices.
- C. Erect all parts of equipment furnished at such time and in such manner as not to delay or interfere with other Trade Contractors and their work.
- D. Plug all piping, conduit and ductwork as required during construction to prevent entering of dirt.
- E. Before material is ordered or fabricated, or any work is performed, verify all calculations, sizing, measurements, including lines, grades, pipes and conduit elevations at the building, as applicable, and be responsible for the correctness thereof. No extra compensation will be allowed on account of differences between actual dimensions, routing and measurements and those indicated in the Contract Documents. Any discrepancies discovered must be submitted to the Engineer for consideration before proceeding with the work.
- F. Lay out work and be responsible for the establishment of heights, grades, and the like, for all interior and exterior equipment and systems as applicable, including piping, drains, fixtures, conduit, and the like, included in Contract Documents, in strict accordance with the intent

expressed thereby; and all the physical conditions to be met at the building and finished grade, and be responsible for accuracy thereof. The establishment of the location of all work must be performed in consideration of the finished work. In case of conflict, equipment and/or materials must be relocated without cost to the Project, as directed by the Engineer, regardless of which equipment was installed first. Refer to Article, "Coordination Drawings", in Part 1 of this section.

- G. Cooperate with other Trade Contractors for the proper securing and anchoring of all work included within these specifications. Use extraordinary care in the erection and installation of all equipment and materials to avoid marring surfaces of the work of other Trade Contractors, as each Trade Contractor will be held financially responsible for all such injury caused by the lack of precaution and due to negligence on the part of the Trade Contractor's work force.
- H. Do not run pipe or conduit in any concrete slab three inches (3") or less in thickness. Do not place any pipe or conduit in any slab where the outside diameter of the pipe or conduit is more than one-quarter the thickness of the slab. The sweep of pipe or conduit elbows emerging through concrete slabs must not create any hazard or obstructions.
- I. All piping, conduit and other materials and equipment shown to be mounted below ceilings are to be kept as close to ceiling areas as possible unless otherwise noted.
- J. Install and arrange all equipment, such as valves, air vents, cleanouts, traps and the like, which will be concealed in construction, to be fully accessible for adjustment, service and maintenance. Furnish access doors where required for installation under the General Construction Contract, where applicable. Otherwise, furnish and install all required access doors.

3.2 PROTECTION OF WORK

- A. Provide all piping, equipment, materials and accessories having polished or plated surfaces, machined finishes or unpainted surfaces with a thick coat of a neutral protection grease and carefully cover with thick cloth or heavy building paper held securely in place to protect the finish against damage during the entire period of construction. Protect equipment by the use of canvas tarps, vinyl sheeting or similar materials held securely in place.
- B. Seal all openings in pipes, fittings, conduit and all other materials to exclude dirt, sand, and other foreign materials.
- C. Exercise every precaution to exclude dust, dirt and all other foreign materials from switchgear rooms, transformers, and all mechanical equipment rooms during construction. Rooms and equipment contained therein must be swept and vacuum cleaned at regular intervals. All relays, meters and plumbing equipment containing electrical components must be protected with heavy paper held in place with approved mastic tape to exclude fine dust and particles. Install and maintain sufficient electric heaters in equipment rooms and transformer compartments to keep equipment dry during construction.

3.3 CUTTING AND PATCHING

- A. New Construction:

1. Perform cutting and patching in accordance with Division 01.
2. Provide and set all sleeves, inserts and other items required for the installation of the Plumbing work, and take responsibility for their final and permanent locations.
3. Confer with, and give the General Construction Trade Contractor, where applicable, complete information as to size of openings in all construction, so that such openings may be provided as the building progresses. Otherwise, provide openings as required for the plumbing work.
4. If openings are omitted or incorrect through failure to follow these instructions the particular Trade Contractor must, at no additional cost to the project, engage the trade which originally installed the work to cut and patch to the satisfaction of the Engineer.

B. For existing construction:

1. The General Construction Trade Contractor, where applicable, will perform all cutting and patching required for the work of all trades. Otherwise, all Trade Contractors are responsible for their own cutting and patching.

3.4 CONCRETE AND MASONRY

- A. Provide all cast-in-place concrete, pre-cast concrete and masonry work (brick and block) required for completion of the plumbing work, including interior and exterior concrete slabs.
- B. Engineer will review and approve materials used.
- C. Unless shown or specified otherwise, all equipment foundations and housekeeping pads must be six inches (6") minimum height from floor, of sufficient mass, and secured to the floor.
- D. Refer to Division 03 for concrete specifications.
- E. Unless noted otherwise, concrete bases must be 4" larger than the largest dimension of the base of the supported equipment in both directions. Use 3000 psi, 28 day compressive strength concrete and reinforcement.

3.5 SUPPORTS

- A. Except where noted otherwise in the specifications and shown on drawings, provide all materials, including, but not limited to, equipment supports, supplies and labor necessary as required to adequately support, brace and strengthen new and/or existing equipment and materials installed under/or affected by the plumbing work.
- B. The design, materials, fabrication and erection of structural steel supports must conform to "Specification for Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, "Code of Standard Practice for Steel Buildings and Bridges". Welding, where required, must conform to "Code of Arc and Gas Welding in Building Construction" of the American Welding Society.

3.6 LINTELS

- A. Lintel work to be performed in strict accordance with Division 01, and Architectural and Structural drawings. Refer to Architectural and Structural Contract Documents for lintel schedules and details.
- B. Where lintels are not indicated as being provided by General Construction or Structural Trade Contractors, the Plumbing Trade Contractor must provide lintels required for the installation and completion of plumbing work.

3.7 ESCUTCHEONS

- A. Except as noted otherwise, provide heavy solid pattern, steel, cast iron or malleable iron escutcheons with set screws and prime coat of paint on all uninsulated piping and conduit exposed to view within structure where passing through floors, partitions, walls or ceilings. Escutcheons are not required in equipment rooms, boiler rooms or other unfinished areas.
- B. For piping with sleeves extending above floor, provide escutcheons with deep recesses.
- C. Provide solid pattern, smooth chrome plated cast brass escutcheons for all chrome plated pipe fixture connections.
- D. Provide nickel plated cast iron escutcheons where pipes pass through toilet rooms, walls or ceilings.

3.8 MACHINERY GUARDS

- A. Provide OSHA approved expanded sheet steel metal guards over all belt drives, couplings and other moving equipment to protect personnel from injury.
- B. Machinery guards shall comply with OSHA Standards 29 CFR STANDARD NUMBER 1910.212 General Requirements for all Machines; Subpart Number 0; Subtitle - Machinery and Machine Guarding; STANDARD NUMBER 1910.219; Standard Title - Mechanical Power - Transmission Apparatus; Subpart Number 0; Subpart Title - Machinery and Machine Guarding.

3.9 ROOFING WORK

- A. Plumbing Trade Contractor shall have all roofing and flashing work performed by warranted roofing installer. Contact Owner or original installer for further information. New penetrations through the roof shall be in full warranty condition. If required by the roof warranty, engage the original roofing installer to perform all roofing and flashing work.

3.10 PAINTING AND FINISHING

- A. All painting, generally, will be provided by the General Construction Trade Contractor, where applicable, except where specifically noted otherwise in the Plumbing Specifications. Otherwise, all Trade Contractors are responsible for their own painting and finishing.

- B. Equipment and material furnished with factory enamel finish will not be painted unless finish has been damaged, in which case the equipment or material must be refinished by the Trade Contractor who furnished it, to the satisfaction of the Engineer.

3.11 PLUMBING TRADE - ELECTRICAL TRADE COORDINATION

- A. Furnish equipment with electrical current characteristics as shown on electrical drawings and specifications.
- B. The nameplate voltage of all motors furnished with mechanical equipment must be within the range of the voltage shown for use with the motor as the upper limit, and 5% less than this voltage as the lower limit.
- C. Plumbing Trade Contractor must furnish all motors, motor starters, specialty motor controllers, float and pressure switches, temperature control, other special automatic controls as indicated in the Contract Documents for all equipment furnished and/or installed under the plumbing contract except where noted otherwise.
- D. All electrical equipment furnished by the Plumbing Trade Contractor must be as recommended by the equipment manufacturers, in accordance with the Electrical Specifications for similar items, and of such type as to work properly with automatic temperature control sequences where required.
- E. The Electrical Trade Contractor will provide all push-buttons, safety switches for motors, and wiring from starters to motors and install all starters furnished to him by the Plumbing Trade Contractor unless otherwise indicated in the Contract Documents.
- F. Where controllers and/or starters are furnished as an integral part of any equipment, the Trade Contractor supplying the equipment must furnish complete wiring between controllers, starters and motors.
- G. The Electrical Trade Contractor must provide disconnect switches for all equipment furnished and/or installed by other Trade Contractors, except where such switches are an integral part of equipment.
- H. Plumbing Trade Contractor must set all motors and furnish, set and pipe as necessary, float switches, temperature control and other special automatic temperature controls.
- I. Plumbing Trade Contractor must provide all power and control wiring required by the respective sections of the specifications. The Electrical Trade Contractor will provide all other wiring required for the completion of the work of the Plumbing Trade Contractor.
- J. Plumbing Trade Contractor must furnish the Electrical Trade Contractor with complete wiring diagrams as required.
- K. Any electrical work performed by the Plumbing Trade Contractor must be performed in accordance with the requirements of the ELECTRICAL Section of these specifications.

3.12 ELECTRICAL MOTORS AND STARTERS

- A. All motors furnished by all Trade Contractors, unless specified to the contrary in Contract Documents, must conform to the following requirements:
1. Characteristics, dimensions, tolerances, temperature rise, insulation, rating, noise, vibration, and all other characteristics in accordance with the latest standards of IEEE or NEMA.
 2. Unless required by the driven unit, motors must have normal starting torque, NEMA Design B characteristics. Horsepower rating of motor must be equal to or greater than that required by driven equipment. Current density design of motor rating must be limited so that overload protection provided by standard motor starters will be adequate to prevent damaging overheating during stall, single phasing or slightly prolonged acceleration.
 3. Use NEMA Class A or B insulation with motor frames amply sized to provide a 1.15 service factor at an ambient of 40 deg. C maximum. Insulation systems must be designed for an average life of 60,000 hours.
 4. All motors must be high efficiency. Meet or exceed requirements in NEMA Standard MG1, Table 12-10.
 5. Running power factor must be higher than 0.85 for motors 5 HP to 30 HP and higher than 0.90 for motors 40 HP or larger.
 6. Each motor must be mounted on the same bedplate as the equipment driven and be complete with pulleys, slide rails or flexible couplings as required.
 7. Each Trade Contractor is responsible in each instance for the proper selection of motors of suitable characteristics with details submitted for approval to the Engineer prior to installation.
- B. All starters furnished by all Trade Contractors must conform with the following requirements, unless specified to the contrary in the Contract Documents:
1. All starters for 3-phase equipment must be fully enclosed, across-the-line type equipped with solid state overload protection as herein specified for all three phases, low voltage protection, all necessary auxiliary contacts as required and indicating pilot lights. Starters which are controlled automatically must have two-wire control with "ON-OFF-AUTO" switches. Starters which are controlled manually must have 3-wire control with Start-Stop pushbuttons.
 2. All 3-phase starters remotely controlled must have 120 volt coils and control transformers with disconnecting means. Starters for single phase motors shall be manual toggle switches with thermal overload protection and pilot light. Omit pilot light for unit heaters.
 3. General Purpose NEMA-1 enclosure for indoor use under normal atmospheric conditions. Watertight enclosure NEMA-4 or NEMA-5 for outdoor use or where starters are subjected to the splashing or dripping of water. Explosion-proof enclosure NEMA-7, 9 or 12 for dusty or hazardous locations as required by Article 500 of the National Electrical Code.
 4. Individually equip all starters for three phase motors with solid state adjustable overload protection with automatic protection to prevent single phase operation with the following features:
 - a. Three phase, self-powered with current sensing, phase unbalance and phase loss protection, visible trip indication, trip test function, and power "LED."

- b. Phase loss protection to include automatic restart with a selectable manual switch.
- C. All controllers, starters and other electrical components furnished as an integral part of any apparatus must be furnished complete with integral wiring as required.
- D. So far as is practical, all motors and starters must be of one manufacturer. Basis of Design: General Electric Co. Comparable products by Westinghouse Co., Square-D Co., or Allen-Bradley Co. may be submitted for review.
- E. Submittals for motors and starters must be coordinated with Electrical Trade Contractor.

3.13 ELECTRICAL PROVISIONS FOR PACKAGED PLUMBING EQUIPMENT

- A. Unless otherwise noted in Plumbing Specifications, all packaged equipment furnished by Plumbing Trade Contractor must be complete with the following electrical provisions:
 - 1. General compliance with provisions of the preceding Article, ELECTRICAL MOTORS AND STARTERS.
 - 2. Starting electrical characteristics of all motors and/or starters must be approved by local utility company and Electrical Engineer.
- B. Approved, factory installed and wired starting, operating and control equipment, terminating in terminal strip for single point power wiring connections by Electrical Trade Contractor must conform with the ELECTRICAL Section of these specifications and must include approved branch fuses for branch power circuits.

3.14 PIPING AND CONDUIT UNDER FLOORS

- A. Wherever piping, conduit or piping enclosures are run under a floor slab on grade, the work is to be installed after the General Construction Trade Contractor, where applicable, has brought the sub-grade to the proper level.
- B. Excavate and backfill as required for the installation of plumbing work. The excavation of the sub-grade where required for the installation of the work must be performed, including that for piping, conduit and piping enclosures, by the Plumbing Trade Contractor. When the installation is completed and satisfactorily tested, the remaining space shall be filled with crushed stone or other material similar to that to be used by the General Construction Trade Contractor, where applicable, for the sub-base. The backfill must be stabilized by hand or pneumatic tamping as directed by the Engineer and must be returned to the original sub-grade level.
- C. No piping, conduit or piping enclosures is to be installed in the stone sub-base which is part of the General Construction Trade Contractor's work, where applicable, unless specific permission is granted by the Engineer.
- D. Where piping is noted to be installed in enclosures, such as split terra cotta pipe, necessary protection of the insulation, arrangement and installation will be as hereinafter described in the detailed technical specifications.

- E. Where required by drawing notes, specifications, or applicable electrical codes, conduits installed under floors must be encased in concrete, conforming to the Division 03 specifications.

3.15 PIPING AND EQUIPMENT IDENTIFICATION

- A. Basis of Design for pipe markers is Setmark snap on type SNA by Seton Nameplate Corporation. Comparable products by Marking Services, Inc. or Brady Worldwide may be submitted for review. Pipe markers must comply with OSHA Standards. Wording and color coding must conform to the current edition of ANSI/ASME A13.1.
- B. Mark all systems of piping with markers 12 foot maximum centers.
- C. Markers must indicate the following:
 - 1. Pipe contents in legend form.
 - 2. Size of piping.
 - 3. Direction of flow in piping.
- D. Identify all valves, controls, dampers and other parts of plumbing systems by means of 2" round brass, aluminum or plastic tags. Tags must have engraved or stamped letters or numbers ½" high. Fasten tags securely with brass "S" hooks or chains. Basis of Design for tags is Seton Corporation. Comparable products by Marking Services, Inc. or Brady Worldwide may be submitted for review.
- E. Provide ½" scale diagrams showing location, number and service or function of each tagged item. Frame diagrams in approved frame with clear Lucite front, secured to walls in location as directed by Owner. Provide two (2) separate copies of each diagram, permanently framed and covered as two (2) separate items.
- F. Identify all equipment as to nature, service and purpose by means of permanently attached plastic nameplates having ½" high letters, dull black outside and white core. Nameplates of approved size, beveled edges and engraved through black to white core. Basis of Design for nameplates is Seton Corp. Comparable products by Marking Services, or Brady Worldwide may be submitted for review. Nameplates shall indicate equipment identification names and numbers as approved by the Owner.

3.16 REMOVAL AND RELOCATION

- A. Removals shown on drawings are a general indication only, and may not necessarily indicate the full extent of removals which may be required to complete this work.
- B. Where existing partitions, walls, ceilings and floors are to be removed, all piping, conduits, materials, fixtures and equipment attached or fastened thereto or within, as applicable, must be carefully removed.
- C. Where work under this contract interferes with the existing construction, ductwork, piping, conduit or equipment, remove all such materials and route new work to clear the obstruction. Provide additional piping, conduits and material of the same design and quality if the piping and/or conduit is to be continued in use.

- D. Disconnect and remove all accessible piping, conduit, ductwork, materials, fixtures and equipment not required in the new systems. Plug all outlets at the main or riser connection.
- E. Removed materials not desired by the Owner and not to be reset and not specified nor indicated to be reused, become the property of the Plumbing Trade Contractor and must be promptly removed from site.
- F. All demolition work is subject to the direction and approval of the Engineer and must be performed in such manner as not to interfere with the normal operation of the building.
- G. Relocate existing utilities and/or equipment that must remain to maintain operation of building or parts of building outside the work area.

3.17 SMOKE AND FIRESTOPPING (METHODS)

- A. Installation of materials must be performed by applicator/installers qualified, trained and approved by the manufacturer of the materials, and be installed in accordance with ASTM E 814.

Install smoke and firestopping at locations required, shown, or specified in accordance with applicable codes, manufacturer's written instructions, and test report, applying to the specific trade equipment as applicable. Cutting and patching of construction and providing sleeves, where required, is shown on drawings or specified in other sections.

- 1. Filling of Voids: Smoke and firestopping materials must completely fill void spaces regardless of geometric configuration, subject to tolerances established by the manufacturer. Smoke and firestopping for filling voids in floors in which the smallest dimension of the void is 4 in. or more must support the same load as the floor is designed to support or must be protected by a permanent barrier to prevent loading or traffic in the smoke or firestopped areas.
 - 2. Insulated Pipes: Insulated equipment penetrating rated floors and walls must be insulated with materials which provide the same performance as the smoke and firestopping material. This material must extend a minimum of 6 in. on each side of the opening. Vapor barrier of such insulation must have a perm rating of 0.03 maximum.
 - 3. Electrical Cables or Conduits: Smoke and firestopping at penetrations of electrical cables or conduits must comply with the requirements of NFPA 70.
 - 4. Where smoke and firestopping of penetrations in floors, walls and partitions that will be exposed in completed construction, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and provide escutcheons or other trim.
 - 5. Schedule the installation and required inspection of smoke and firestops for penetrations that will be concealed in completed construction prior to erection of floors, walls, and partitions that would permanently conceal the penetrations.
- B. All areas of smoke and firestopping installation must be accessible until inspection by the applicable code authorities.

3.18 SUBSURFACE CONCEALED UNKNOWN PHYSICAL CONDITIONS

- A. Subsurface, or otherwise concealed physical conditions which (1) do not differ materially from those indicated in the Project Contract Documents; (2) affect plumbing and electrical work; (3) do not differ materially from those ordinarily found to exist, and which are generally recognized as inherent in the mechanical and electrical construction activities of the character provided for in the Project Contract Documents, are to be anticipated by the Plumbing Trade Contractor, and included in the basic plumbing work.
- B. Unknown physical conditions: which are of an unusual nature; which are materially different in subsurface (otherwise concealed) physical conditions; which affect plumbing and/or electrical work; which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character found in the Project Contract Documents, are the basis for, and require notice by, the applicable Trade Contractor, promptly, before such conditions are disturbed. Such conditions may become the basis for a legitimate claim under "Changed Conditions," affecting the cost, and/or schedule of the work. During the work, the Plumbing Trade Contractor shall provide reasonable, incidental on-site review, survey and measurements to assist in quantification of such conditions.

3.19 CONCRETE PATCHING (PROCEDURE)

- A. Remove any loose debris, chipped or cracked portions of concrete, and any grease, oil, dirt or other coating materials from the concrete to be patched.
- B. Apply epoxy bonding adhesive to the clean dry surface with a brush or roller to briefly flood the surface allowing good penetration, if completely absorbed, apply additional material. Adhesive Basis of Design: Edison Coatings Inc. Flexi-Bond 540. Comparable product by Sika Corp. or Euclid Chemical Co. may be submitted for review. Refer to Division 03 of these specifications.
- C. Apply new cementitious mortar patch to surface immediately after applying bonding adhesive, bonding agent should be wet while applying concrete patch. Mortar patch equal to Moxie International 2000 Super Patch. Comparable product by Sika Corp. or Euclid Chemical Co. may be submitted for review. Refer to Division 03 of these specifications.
- D. Work patch into any cracks or crevices with a brush, then apply remainder of patch and trowel until level and smooth.
- E. Do not apply patch below 45 deg. F.

3.20 INITIAL APPLICATION FOR PAYMENT

- A. Provide the following prior to submitting the initial application for payment:
 - 1. Copy of Plumbing Trade Contractor's and Sub-Contractors' licenses for the state in which the work is being performed.
 - 2. Resumes for the designated Project Manager and Project Foreman.
 - 3. List of independent agencies who will be engaged by the Plumbing Trade Contractor to perform tests, provide certifications, conduct inspections, etc. as required by Contract Documents.

- B. The initial application for payment will not be processed until the items above are submitted.

3.21 FINAL APPLICATION FOR PAYMENT

- A. Provide the following prior to submitting the final application for payment:
 - 1. Refer to Division 01 of these specifications.
 - 2. Pipe Pressure Test Reports.
 - 3. Equipment Start-Up Reports for each piece of plumbing equipment.
 - 4. Operation and Maintenance Manuals and Data.
 - 5. Testing, Adjusting and Balancing Report for plumbing systems.
 - 6. Plumbing system and equipment warranties.
 - 7. Plumbing Contractor's Punch List of incomplete work items with reason why each work item is not complete and anticipated schedule for completion. Submit at least one week prior to Engineer's final Construction Observation Report site visit.
 - 8. Plumbing Trade Contractor's notarized certification letter.
 - 9. As-built drawings.
- B. Final payment is contingent upon completion of all items listed above.

END OF SECTION 220010

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

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. Sleeve-seal systems.
 - 2. Sleeve-seal fittings.
 - 3. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated, with plain ends and integral welded waterstop collar.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description:
 - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve for a waterproof seal.
 - 2. Designed to form a hydrostatic seal of 20 psig minimum.

3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.
- B. Plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in partitions and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 1. Sleeves are not required for core-drilled holes.
- C. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system or Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 2. Interior Partitions:
 - a. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 220517

SECTION 220533 - HEAT TRACING FOR PLUMBING PIPING

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 heat tracing for Plumbing piping on level B of the Parking Garage.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
 - 2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
- B. Shop Drawings: For electric heating cable.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years for the heat trace cables and 2 year for the controllers from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HEATING CABLES

- A. Products shall be as manufactured by one of the following (Basis of design: NVent: XL-Trace):
 1. nVent: Raychem.
 2. Delta-Therm Corporation.
 3. Orbit Manufacturing.
- B. Comply with IEEE 515.1.
- C. Heating Element: Nickel plated copper bus wire with self-regulating conductive core, modified polyolefin inner jacket, tinned copper braid, Modified polyolefin outer jacket.
- D. Powered Connection Kits – Waterproof, UV-resistant enclosure. Kit includes 5' power lead wires, a conduit fitting; pipe mounting bracket and end seal. The kits shall be for one, two or three heating cables. Basis of design: NVent RayClic.
- E. Heat-Tracing Control System:
 1. Provides accurate temperature control with integrated 30-mA ground fault protection.
 2. One for each Heat trace circuit with NEMA 4X enclosure.
 3. Controller includes window and a digital display showing measured temperature, set point temperature and alarm conditions along with a dry contact for alarm annunciation back to the building management system.
 4. The controller shall be set to monitor an alarm for high and low temperature, low current, and ground fault level.
- F. Maximum Fluid Operating Temperature: <150 deg F
- G. Maximum Ambient Temperature: 120 deg F.
- H. Minimum Ambient Temperature: 0 deg F.
- I. Relative Humidity: 0 to 90%, non-condensing.
- J. Control: On/Off via line Sensor. Energize heat trace at pipe temperature drops below 40 deg F. De-energize the heat trace when the pipe temperature rises above 45 degrees F.
- K. 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.

2.2 ACCESSORIES

- A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
- B. Glass tape for attaching heating cable to pipe.
- C. Piping Warning Labels: "Electric Traced" label for identifying traced pipes, valves and fittings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions. Prepare existing pipe surfaces as recommended by the heat trace manufacturer.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Coordinate installation of the heat tracing with the piping insulation removal and new insulation.

3.2 INSTALLATION

- A. Install electric heating cable across expansion joints according to manufacturer's written instructions; use slack cable to allow movement without damage to cable.
- B. Install electric heating cables after piping has been tested and before insulation is installed.
- C. Install electric heating cables according to IEEE 515.1.
- D. Install warning labels every 10 ft on piping insulation where piping is equipped with electric heating cables.
- E. Set field-adjustable switches and circuit-breaker trip ranges.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
 - 1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
 - 2. Test cables for electrical continuity and insulation integrity before energizing.
 - 3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
- C. Cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 PROTECTION

- A. Protect installed heating cables, including nonheating leads, from damage during construction.
- B. Remove and replace damaged heat-tracing cables.

END OF SECTION 230533

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
 - 4. Sanitary waste piping and sump pump basin exposed to freezing conditions.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of the manufacturer, fabricator, type, description, and size.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and new insulation shields.
- B. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
 - 1. All Insulation: Shall have a Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," and "Outdoor, Aboveground Piping Insulation Schedule," articles for where insulating materials are applied.
- B. Products do not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe: Bonded with a water repellent thermosetting resin. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Manson Insulation Inc.
2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ-SSL.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 INSULATING CEMENTS

- A. Mineral-Fiber Wool Insulating Cement: Comply with ASTM C195.

2.4 ADHESIVES

- A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

2.5 MASTICS AND COATINGS

- A. Materials are compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 2. Service Temperature Range: 0 to plus 180 deg F.
 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
 4. Color: White.

2.6 LAGGING ADHESIVES

- A. Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.
 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 2. Service Temperature Range: 0 to plus 180 deg F.
 3. Color: White.

2.7 SEALANTS

- A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

1. Permanently flexible, elastomeric sealant.
2. Service Temperature Range: Minus 58 to plus 176 deg F.
3. Color: White or gray.

C. ASJ Flashing Sealants:

1. Fire- and water-resistant, flexible, elastomeric sealant.
2. Service Temperature Range: Minus 40 to plus 250 deg F.
3. Color: White.

2.8 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

B. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.

2.10 SECUREMENTS

A. Bands:

1. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
- D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.

- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
 - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation tight to existing insulation through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- B. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation tight to existing insulation through floor penetrations.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.
- B. Insulation Installation on Fittings, Flanges, Mechanical Couplings, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
 - 4. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and sump pump basin:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

3.7 INSTALLATION OF FIELD-APPLIED JACKETS

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

- A. Do not field paint aluminum jackets.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to one locations of straight pipe, for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE (Exg. exposed piping on level B of the unconditioned Parking Garage routed between columns H and J).

A. Domestic Water Piping:

- 1. All Pipe Sizes: Insulation is the following:

- a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water:

- 1. All Pipe Sizes: Insulation is the following:

- a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

C. Sanitary Waste Piping and Sump Pump Basin (Parking Garage Fire pump Room):

- 1. All Pipe Sizes: Insulation is the following:

- a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE (Exg. exposed piping on level B of the unconditioned Parking Garage routed between columns H and J).

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. Painted Aluminum, Smooth: 0.032 inch thick.
- D. Sump Pump Basin associated with the sump pump in the parking garage fire pump room.
 - 1. Painted Aluminum, Smooth: 0.032 inch thick.

END OF SECTION 220719

SECTION 221123 - FACILITY NATURAL-GAS PIPING

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. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Manual gas shutoff valves.
 - 5. Pressure regulators.
 - 6. Dielectric fittings.

1.3 DEFINITIONS

- A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, spaces above ceilings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 3. Pressure regulators. Indicate pressure ratings and capacities.
 - 4. Dielectric fittings.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
 - 1. Shop Drawing Scale: 1/4 inch per foot.

2. Detail mounting, supports, and valve arrangements for pressure regulator assembly.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- B. Qualification Data: For qualified professional engineer.
- C. Welding certificates.
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pressure regulators to include in operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. 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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. 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.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.9 PROJECT CONDITIONS

- A. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 1. Notify Architect no fewer than seven days in advance of proposed interruption of natural-gas service.

2. Do not proceed with interruption of natural-gas service without Own's written permission.

1.10 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure: 2 psig (new service and existing service with increased load)

2.2 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground.
 5. Steel Pressure Seal Fittings: Viega MegaPress for Natural Fuel Gas Systems or equal. Fittings to conform to material requirements in ASTM A420 or ASME B16.3 and performance criteria of ANSI/CSA LC4. Sealing elements shall be HNBR (Hydrogenated Nitrile Butadiene Rubber). Utilize Manufacturer's special tools and ensure joints are rated for 180 deg F and 125 psig.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Corrugated stainless-steel tubing with polymer coating.
4. Operating-Pressure Rating: 0.5 psig.
5. End Fittings: Zinc-coated steel.
6. Threaded Ends: Comply with ASME B1.20.1.
7. Maximum Length: 72 inches.

2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. 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.

2.5 MANUAL GAS SHUTOFF VALVES

A. See "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Lockable.
7. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Products shall be as manufactured by one of the following:

- a. Nibco, Inc.
 - b. A.Y. McDonald Mfg. Co.
 - c. Apollo Flow Controls; Conbraco Industries, Inc.
 2. Body: Bronze, complying with ASTM B584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
1. Products shall be as manufactured by one of the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Mueller Co.
 - c. Xomox Corporation.
 2. Body: Cast iron, complying with ASTM A126, Class B.
 3. Lockable.
 4. Plug: Bronze or nickel-plated cast iron.
 5. Seat: Coated with thermoplastic.
 6. Stem Seal: Compatible with natural gas.
 7. Ends: Threaded or flanged as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. Operator: Square head or lug type with tamperproof feature where indicated.
 9. Pressure Class: 125 psig.
 10. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 11. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Products shall be as manufactured by one of the following:

- a. American Meter Company.
 - b. Fisher Control Valves & Instruments; a brand of Emerson Process Management.
 - c. Richards Industries.
 - d. Maxitrol Company.
 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 6. Orifice: Aluminum; interchangeable.
 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 10. Overpressure Protection Device: Factory mounted on pressure regulator.
 11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 12. Maximum Inlet Pressure: 5 psig.
- C. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Products shall be as manufactured by one of the following:
 - a. Eaton.
 - b. Harper Wyman Co.
 - c. SCP, Inc.
 - d. Maxitrol Company.
 2. Body and Diaphragm Case: Die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber.
 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
 8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
 9. Maximum Inlet Pressure: 2 psig.

2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. Standard: ASSE 1079.
 2. Pressure Rating: 125 psig minimum at 180 deg F.
 3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Description:

- a. Standard: ASSE 1079.
- b. Factory-fabricated, bolted, companion-flange assembly.
- c. Pressure Rating: 125 psig minimum at 180 deg F.
- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping indicated to be exposed at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Locate valves for easy access.
- E. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.

- H. Verify final equipment locations for roughing-in.
- I. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- J. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- K. Extend relief vent connections for line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- L. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- M. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- N. Do not use natural-gas piping as grounding electrode.
- O. Install strainer on inlet of each line-pressure regulator.
- P. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 22 Sections.
- Q. Provide protection of gas piping where it is exposed to potential damage. Coordinate with the engineer and owner. Piping protection shall meet the requirements of NFPA.

3.4 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.5 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. 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.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in applicable Division 22 Sections.
- B. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Support horizontal piping within 12 inches of each fitting.
- D. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 CONNECTIONS

- A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 LABELING AND IDENTIFYING

- A. Comply with requirements in applicable Divisions 22 Sections for piping and valve identification.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.10 OUTDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 5 PSIG

- A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum O-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 - 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, electrically insulated coating, per the manufacturer's recommendations and meeting the requirements of the IFGC. Fittings and joints between sections of coated pipe shall be coated in accordance with the coating manufacturer's instructions.
 - 6. Provide cathodic protection for all underground piping in accordance with the IFGC codes and AHJ requirements.
- B. Aboveground, distribution piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints or pressure sealed joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Factory applied protective coating as recommended by the piping manufacturer to prevent corrosion.

3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:
 1. Two-piece, full port, bronze ball valves with bronze trim.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Cast-iron, nonlubricated plug valve.
- C. Valves in branch piping for single appliance shall be the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 221123

SECTION 221316 - SANITARY WASTE AND VENT PIPING

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. Hub-and-spigot, cast-iron soil pipe and fittings.
 - 2. Hubless, cast-iron soil pipe and fittings.
 - 3. PVC pipe and fittings.
 - 4. Specialty pipe fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste 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 according to requirements indicated:
 - 1. Notify Owner no fewer than seven days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

1.5 WARRANTY

- A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Waste, Force-Main Piping: 50 psig.

2.2 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 1. Standards: ASTM C 1277 and CISPI 310.
 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 COPPER TUBE AND FITTINGS

- A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
- D. Copper Pressure Fittings:
 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- E. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.6 PVC PIPE AND FITTINGS

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- E. Adhesive Primer: ASTM F 656.
- F. Solvent Cement: ASTM D 2564.

2.7 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 2. Unshielded, Nonpressure Transition Couplings:
 - a. Standard: ASTM C 1173.
 - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - c. End Connections: Same size as and compatible with pipes to be joined.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 - 3. Pressure Transition Couplings:
 - a. Standard: AWWA C219.
 - b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - c. Center-Sleeve Material: Manufacturer's standard.
 - d. Gasket Material: Natural or synthetic rubber.
 - e. Metal Component Finish: Corrosion-resistant coating or material.
- B. Dielectric Fittings:
 - 1. Dielectric Unions:
 - a. Description:

- 1) Standard: ASSE 1079.
- 2) Pressure Rating: 125 psig minimum at 180 deg F.
- 3) End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
 1. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. 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.
- C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- 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. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 3. Do not change direction of flow more than 90 degrees.
 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.
- I. Lay buried building waste piping beginning at low point of each system.
 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

3. Maintain swab in piping and pull past each joint as completed.
- J. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- M. Install sleeves for piping penetrations of walls, ceilings, and floors.
- N. Install sleeve seals for piping penetrations of concrete walls and slabs.
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.3 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 1. Install transition couplings at joints of piping with small differences in ODs.
 2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.
 3. In Aboveground Force Main Piping: Fitting-type transition couplings.

4. In Underground Force Main Piping:
 - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
 - b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.

3.4 VALVE INSTALLATION

- A. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hanger and support devices and installation specified in applicable Division 22 Sections.
 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
 4. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- B. Install hangers for cast-iron and copper soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- D. Support vertical runs of cast iron and copper soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Equipment: Connect waste piping as indicated.
 - a. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sump Pump: To sump pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. 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.

3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in applicable Division 22 Sections.

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

- a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
 - c. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
 - a. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.
 - a. Isolate test source and allow to stand for four hours.
 - b. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
 - 3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.
 - 3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be the following:
 - 1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.

END OF SECTION 221316

SECTION 221319.13 - SANITARY DRAINS

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. Floor drains.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
 - 1. Provide equipment as manufactured by one of the following:
 - a. Jay R. Smith Mfg Co; a division of Morris Group International.
 - b. Josam Company.
 - c. Zurn Industries, LLC.
 - 2. Standard: ASME A112.6.3.
 - 3. Pattern: Floor drain.
 - 4. Body Material: Gray iron.
 - 5. Outlet: Bottom.
 - 6. Coating on Interior and Exposed Exterior Surfaces: Not required.
 - 7. Sediment Bucket: Removable.
 - 8. Top or Strainer Material: Gray iron.

9. Top Shape: Square.
10. Top Loading Classification: Medium Duty.
11. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
12. Trap Pattern: Standard P-trap.
13. Trap Features: Barrier-type trap seal protection device conforming to ASSE 1072 and installed in accordance with the manufacturer's instructions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 3. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.2 CONNECTIONS

- A. Comply with requirements in applicable Division 22 Sections.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

SECTION 221429 - SUMP PUMPS

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. Submersible sump pumps.
 - 2. Sump-pump basins and basin covers.
 - 3. Free standing ejector pump.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and mounting details.
 - 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 4. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.

- C. Comply with manufacturer's written instructions for handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

2.2 SUBMERSIBLE SUMP PUMPS

- A. Submersible, Fixed-Position, Recessed Basin, Single-Seal Sump Pumps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bell & Gossett; a Xylem brand.
 - b. Grundfos Pumps Corp.
 - c. Little Giant; a Franklin Electric brand.
 - d. Zoeller Company.
2. Description: Factory-assembled and -tested sump-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing and motor housing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, ASTM A48/A48M, Class No. 25 A cast iron design for clear wastewater handling, and keyed and secured to shaft.
6. Solids Handling: 5/8" spherical solids.
7. Pump and Motor Shaft: AISI 1215 cold rolled steel.
8. Hardware: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
9. Seal: Mechanical carbon and ceramic.
10. Gasket; Neoprene.
11. Motor: Hermetically sealed, class B, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - a. Motor Housing Fluid: Oil.
12. Controls:
 - a. Enclosure: NEMA 250, Type 4X wall mounted.
 - b. Switch Type: Mechanical-float or Mercury-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 - c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.

- d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float or mercury-float switch matching control and electric bell; 120 V ac, with transformer and contacts for remote alarm.
- 13. Control-Interface Features:
 - a. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - 1) On-off status of pump.
 - 2) Alarm status.
- B. Submersible, Fixed-Position, Single-Seal Sump Pumps with Free Standing Basin:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bell & Gossett; a Xylem brand.
 - b. Grundfos Pumps Corp.
 - c. Little Giant; a Franklin Electric brand.
 - d. Zoeller Company.
 - 2. Description: Factory-assembled and -tested sump-pump unit.
 - 3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
 - 4. Pump Casing and motor housing: Epoxy coated Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 - 5. Impeller: Statically and dynamically balanced, ASTM A48/A48M, thermoplastic elastomer.
 - 6. Solids Handling: 2" spherical solids.
 - 7. Pump and Motor Shaft: AISI 1215 cold rolled steel.
 - 8. Hardware: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
 - 9. Seal: Mechanical carbon and ceramic.
 - 10. Gasket; Neoprene.
 - 11. Inlet & Outlet sizes: 2".
 - 12. Liquid temperature: 140F maximum.
 - 13. Motor: Hermetically sealed, class B, permanent split capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
 - a. Motor Housing Fluid: Oil.
- 14. Controls:
 - a. Enclosure: NEMA 250, Type 4X wall mounted.
 - b. Switch Type: Mechanical-float or Mercury-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.

- c. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float or mercury-float switch matching control and electric bell; 120 V ac, with transformer and contacts for remote alarm.
- d. Control panel with disconnect.

15. Control-Interface Features:

- a. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - 1) On-off status of pump.
 - 2) Alarm status.

2.3 SUMP-PUMP BASINS AND BASIN COVERS

- A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
 - 1. Material: Fiberglass (Parking Garage) & Roto-molded polyethylene ribbed design (Court House).
 - 2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
- B. Basin Covers (Parking Garage) Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
 - 1. Reinforcement: Steel or cast iron, capable of supporting foot traffic.
- C. Basin Covers (Court House) Radial rib design for extra strength, gasketed connection, seals, molded inlet hub, molded handle, alarms, pump access cover, monolithic molded basin top.

2.4 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in applicable division 22 sections.
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for plumbing piping to verify actual locations of existing sanitary drainage piping connections before sump pump installation.

3.2 INSTALLATION

- A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

3.3 CONNECTIONS

- A. Where installing piping adjacent to equipment, allow space for service and maintenance.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test, inspect, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections:
 - 1. Perform each visual and mechanical inspection.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Pumps and controls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.6 ADJUSTING

- A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust control set points.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 221429

SECTION 230010 - GENERAL REQUIREMENTS HVAC

PART 1 - GENERAL REQUIREMENTS HVAC

1.1 GENERAL

- A. The conditions of Divisions 00 and 01 apply to each and every Trade Contractor or other person or persons supplying any material or labor entering this building and/or site, either directly or indirectly. In the event of a conflict between Section 230010 and Divisions 00 and 01, the terms of Divisions 00 and 01 shall govern.
- B. One Building Trade, the Heating, Ventilating and Air Conditioning (HVAC) Building Trade, will be covered by these General Requirements HVAC.
- C. For simplicity, this Building Trade will be referred to further herein as the HVAC Trade Contractor. The HVAC Specifications and all HVAC Drawings, together with all addenda make-up the HVAC Contract Documents, and are a part of the "Project Contract Documents", as described throughout these specifications.
- D. The term "Electrical Trade" as used in the Contract Documents, means the Electrical Building Trade.
- E. The term "indicated" means all information included, detailed, shown and/or implied on the Contract Documents.
- F. The term "existing" is used generally in reference to renovation projects. On new construction projects, the term "existing" is intended to mean work already in place.

1.2 INTENT OF THE HVAC CONTRACT DOCUMENTS

- A. The intent of the HVAC Contract Documents is to include all items and labor necessary for the proper execution and completion of the Work of the HVAC Trade Contractor. The Contract Documents of all Trades are complimentary to each other; what is required by one shall be as binding as if required by all. Performance of the HVAC Trade Contractor is required only to the extent consistent with the Project Contract Documents and reasonably inferable from them as being necessary to produce the desired results.
- B. It is expressly stipulated that neither the Drawings nor the Specifications shall take precedence over the other, and it is further stipulated that the Architect/Engineer may interpret or construe the Drawings and Specifications so as to secure in all cases the result most consistent with the needs and requirements of the work. In the event of such ambiguity or discrepancy, comply with the higher cost product (material plus labor), the more stringent requirement, and supply the better quality or greater quantity of work.

1.3 PROPOSAL PREPARATION

- A. Prior to submitting a pricing quotation/proposal, proceed as follows, and include the following:

1. Visit the site, survey, record, confirm and include in the scope of work, all material and labor necessary to install the equipment and systems indicated. Use the Contract Documents as diagrammatic in nature, since they are not intended to show all details which may affect the HVAC bid proposal.
2. Include the work, as applicable, to remove and dispose of conduit, piping, insulation, ductwork, equipment and appurtenances not required for new work, unless otherwise indicated to be abandoned in place.
3. Include all disconnections, removals and temporary provisions required to permit rigging, installation, connection, testing and operation of the new equipment. Include all such provisions whether or not shown, detailed or specified within technical sections of the Contract Documents.
4. Include in the work, providing the labor of Keymen, including, but not limited to the following:
 - a. One Project Manager;
 - b. One Project Foreman;
5. Foreman must refine the detail, layout, coordination and fit of all of HVAC equipment. Plan all disconnections, removals, offsets, temporary provisions, as required, to fit the new equipment into the space, and as required to accommodate maintenance accessibility and service access.
6. Project Manager must maintain and submit for approval, a written project schedule, on a weekly basis.
7. All Project Managers must organize, administrate, control and log the RFI process for their respective trade. Where applicable, submit all RFI(s) for master RFI log maintained by Lead/Prime Contractor.

B. In preparing a Bid Price:

1. Thoroughly review and confirm all existing conditions and Contract Document information. Make note in writing of any exceptions, misunderstandings, unclear areas, unclear directions, and any aspects which will prohibit completion of the work, in total. Failing to supply such notice, all bidders will be accountable for having accepted all conditions at the site which affect their work and their costs. By submitting a bid price, all Trade Contractors certify that the Contract Documents have been thoroughly reviewed and are sufficient for construction, and that the bidding Trade Contractors have adequate information to establish and determine their responsibility for materials, methods, costs, and schedule for their work.
2. Incorporate all requirements of all sections of the Contract Documents.
3. Include the following with the Manufacturer's and Sub-Contractor's Lists:
 - a. The name and telephone number of all Sub-Contractors.

1.4 HAZARDOUS MATERIALS

- A. The use of asbestos, PCB's or any material or product containing hazardous materials in the performance of this contract is not permitted. Certify, in writing, that no hazardous material or product containing a hazardous material, has been furnished or installed.

1.5 DRAWINGS AND SPECIFICATIONS

- A. It is the intent of the specifications and drawings to include under each item all materials, apparatus and labor 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 properly operating whole.
- B. Any apparatus, machinery, small items not mentioned in detail which are necessary to complete or perfect any portion of the installation in a substantial manner and in compliance with the requirements stated, implied or intended must be furnished and/or installed without extra cost to the Project. This includes all materials, devices or methods peculiar to the machinery, apparatus or systems furnished and/or installed by the HVAC Trade Contractor.
- C. In referring to drawings, figured dimensions take precedence over scale measurements. Verify all wall locations, ceiling heights, elevations, dimensions, etc. on the architectural drawings, where applicable. Discrepancies must be referred to the Engineer for decision. Certify and verify all dimensions, routings and layouts in the field and on the coordination drawings before ordering material or commencing work.
- D. Any work called for in the specifications, but not mentioned or shown on the drawings, or called for on the drawings, but not mentioned in the specifications, must be furnished and/or installed as though called for in both.
- E. When any device or part of equipment is herein referred to in the singular number, such as "the pump" such reference is deemed to apply to as many such devices as required to complete the installation.
- F. The term "Provide" means "Furnish and Install". Neither term will be used generally in these specifications, but will be assumed. The term "Furnish" means to obtain and deliver to the job site for installation by other trades.

1.6 LAWS, ORDINANCES, REGULATIONS AND PERMITS

- A. The entire HVAC system in all and/or in part must conform to all pertinent laws, ordinances and regulations of all bodies having jurisdiction, notwithstanding anything in these drawings or specifications to the contrary.
- B. Pay all fees and obtain and pay for all permits and inspections required by any authority having jurisdiction in connection with the work under this contract.
- C. Electrical work performed by the HVAC Trade Contractor must comply with the requirements of the National Electrical Code, NFPA and other boards and departments having local jurisdiction.

1.7 TESTS

- A. The following requirements are supplementary to tests specified for individual equipment or systems in other specification sections. Give written notice of date of test in ample time to all concerned.

- B. Concealed or insulated work must remain uncovered until all required tests have been completed; but if construction schedule requires, arrange for partial tests on portions of systems as approved. If a Prime Contractor covers or directs a Sub-Contractor to cover HVAC work prior to completing the required tests, the Prime Contractor is responsible for any additional costs related to completing the required tests.
- C. As soon as conditions permit, conduct preliminary tests of equipment to ascertain compliance with specified requirements. Make needed changes, adjustments and/or replacements as preliminary tests may indicate, prior to acceptance tests.
- D. Conduct pressure, performance and operating tests as specified or required for each system or piece of equipment installed, modified or affected under this contract in presence of the Engineer or Owner as well as a representative of agencies having jurisdiction.
- E. Obtain Certificates of Approval and/or Acceptance as specified or required in compliance with regulations of agencies having jurisdiction. Work will not be deemed complete until such Certificates have been delivered to the Engineer.
- F. Prove conclusively, by testing, that HVAC systems operate properly, efficiently and quietly in accordance with intent of drawings, specifications and most widely used construction practices.

1.8 CLEANING

- A. Be responsible for the following:
 - 1. Removal of all lumber, refuse, metal, piping and debris from site resulting from HVAC work.
 - 2. Cleaning drippings created by the HVAC work, from finished work of other Trades.
 - 3. Cleaning, polishing, waxing of HVAC work as required.
- B. After testing, and acceptance of all work by the Engineer and the Owner, thoroughly clean all HVAC equipment and material to the satisfaction of the Engineer.

1.9 ENTRANCE OF EQUIPMENT

- A. Determine the method of equipment entrance during initial site visit prior to bidding. Do not scale building openings, door widths and equipment or component sizes off the drawings. Determine sizes from site measurements and equipment manufacturer. Include cost of equipment manufacturer's knockdown, use of field assembled equipment, field assembly, all work required for access, removals, replacements, general construction, and the like, as required. During preparation of submittals, verify whether knocked-down or pre-disassembled equipment have been proposed all to the extent required to permit entry of equipment to final location. Verify that the use of field assembled (not pre-assembled) equipment complies with manufacturer's warranty, guarantee, listings and requirements.
- B. Perform all necessary rigging required for completion of HVAC work.

- C. Deliver products to the site properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification. Deliver products and equipment to the site properly weatherproofed.
- D. The Trade Contractor who furnishes or purchases the product or equipment is responsible to provide and maintain protection from the weather, dust, dirt, construction debris, etc. until the project is complete.
- E. For all products and equipment which, when installed, have an opening into the building must be provided with a plywood cover, or similar protection, to prevent debris, rain, etc. from entering the building. The Trade Contractor who installs the product or equipment is responsible for such protection beginning at the time of installation.

1.10 GUARANTEE

- A. All material, equipment and workmanship must be in first class operating condition in every respect at time of acceptance by Owner. Acceptance by the Owner will be by letter written to the HVAC Trade Contractor.
- B. Unconditionally guarantee in writing all materials, equipment and workmanship for a period of one (1) year from date of acceptance by Owner. During the guarantee period, repair or replace, at the HVAC Trade Contractor's expense, any materials, equipment or workmanship in which defects may develop and provide free service for all equipment and systems involved in the contract during this guarantee period. Beneficial use of any system by any of the Trade Contractors during construction does not constitute acceptance by the Owner. Time period of this beneficial use cannot be included in the guarantee period.
- C. Guarantee must also include restoration to its original condition of all adjacent work that is disturbed in fulfilling this guarantee.
- D. All such repairs and/or replacements must be made without delay and at the convenience of the Owner.
- E. Guarantees furnished by Trade Contractors and/or equipment manufacturers must be countersigned by the related Trade Contractor for joint and/or individual responsibility for subject item.
- F. Manufacturers' equipment guarantees or warranties extending beyond the guarantee period described in item B above must be transferred to the Owner along with the Trade Contractor's guarantees.

1.11 SERVICING OF EQUIPMENT AND SYSTEMS

- A. After work has been completed in accordance with the Contract Documents, and prior to final acceptance tests, each Trade Contractor must have manufacturers or their authorized agents of the equipment installed, completely check their equipment and put equipment into proper operation. In each case, the respective Trade Contractor must have the manufacturers thoroughly check the complete installation of the equipment, furnished by the manufacturer, for proper and correct operation under the service intended.

- B. Prior to expiration of the guarantee period, each Trade Contractor must check all equipment, materials and systems for which he is responsible, make necessary adjustments and/or replacements, and leave systems in first class operating condition.

1.12 CONTINUITY OF SERVICES

- A. Generally, no actions can be taken by the HVAC Trade Contractor that will interrupt any of the existing building services for these buildings or any other building until previously arranged and scheduled with the Engineer and Owner.
- B. Should any service be interrupted by the HVAC Trade Contractor, immediately provide all labor, including overtime if necessary, and all material and equipment necessary for restoration of such service, at no additional cost to the Project.

1.13 SMOKE AND FIRESTOPPING (GENERAL)

- A. Furnish and install a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and to maintain the integrity of the "fire and/or smoke" rated construction. Refer to Division 07 of these specifications. Fire and smoke rated construction is identified on the Architectural Drawings. Provide firestopping in the following locations:
 - 1. Ductwork and conduit penetrations through above grade floor slabs and through "fire and/or smoke"-rated partitions and fire walls.
 - 2. Other locations where, indicated or required.
- B. Prepare submittals and submit for approval. Include manufacturer's descriptive data, typical details, installation instructions and the fire/smoke test data and/or report as appropriate for the time rated construction and location. The fire/smoke test data must include a certification by a nationally recognized testing authority that the material has been tested in accordance with ASTM E 814, or UL 1479 fire tests.
- C. Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, and protect from damage and exposure to elements. Damaged, deteriorated or outdated shelf life materials shall not be used and must be removed from the site.

1.14 COORDINATION DRAWINGS

- A. The Plumbing Contractor shall initiate coordination drawings. The HVAC Trade Contractor must coordinate HVAC work with the Plumbing Contractor. Coordination drawings shall detail major elements, components, and systems of equipment and materials in relationship with other systems, installations, and building components. Use proposed equipment submittals, which include certified dimensions, service clearances, etc., to prepare the coordination drawings. If equipment is submitted for review after completion of the coordination drawings and rejected during the submittal review process, because the equipment fails to meet the project specifications, the Contractor is responsible to coordinate revision to the coordination drawings and layout the work using equipment which meets the project specifications.

1. Indicate the proposed locations of ductwork, equipment, and materials. Include the following:
 - a. Clearances for installing and maintaining insulation.
 - b. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - c. Equipment connections and support details.
 - d. Exterior wall and foundation penetrations.
 - e. Fire-rated wall and floor penetrations.
 - f. Location of structural columns, beams and supports.
2. The foregoing information and coordination work must be provided by the applicable Trade Contractor using the coordination drawings as initiated by the Plumbing Contractor.

1.15 TRADE CONTRACTOR'S CERTIFICATION

- A. Upon final completion of all work, each Trade Contractor must provide a notarized letter on Corporate letterhead, executed by a Corporate Officer, or Company Partner, stating that the work has been completed in accordance with the Contract Documents, Addenda, Bulletins, Trade Contractor's Punch List items and Architect's/Engineer's Construction Observation Report(s). Final Payment will not be approved until the notarized letter has been provided. Refer to the following sample letter.

SAMPLE LETTER

ENGINEER/ARCHITECT _____

TRADE CONTRACTOR _____

PROJECT _____ NO. _____

I hereby certify that all work under the HVAC, Plumbing, Fire Protection and Electrical Contract Documents, as applicable, including all addenda, bulletins, Punch List items and Construction Observation Reports, has been completed and the quality and workmanship of the work has been performed in accordance with Contract Documents.

State of: _____

County of: _____

Trade Contractor: _____

Subscribed and Sworn to before
me this _____ day of
20 _____

Notary Public: _____

By: _____

Date: _____

My Commission Expires: _____

(Ctrl) +

PART 2 - PRODUCTS

2.1 MANUFACTURER'S AND SUB-CONTRACTORS LIST, KEYMEN RESUMES

- A. Before ordering any material or equipment unit, and not later than ten (10) working days after signing of contracts, submit a list of Manufacturers, Sub-Contractors and Suppliers showing make, type, manufacturer's name and trade designation of all materials, and equipment, proposed for use under this contract. Prepare list by reference to specifications. Identify all long lead submittals which will require an expedited submittal review.
- B. Refer to the Article "Proposal Preparation," in this section. Specifically designate the labor force required of the HVAC Trade Contractor. As part of the mobilization phase of the work, submit resumes for each Keyman including the Project Manager and Project Foreman.
- C. These lists, when approved, will be supplementary to specifications, and no variations therefrom will be permitted except with the approval of the Engineer.

- D. Submittals will not be processed until the requirements of this Article are satisfactorily completed.

2.2 MATERIALS AND EQUIPMENT

- A. All materials and equipment must be new and conform to the grade, quality and standards specified herein.
- B. All equipment offered under these specifications is limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature made available to the public and in effect at the time of opening of bids. Testing agency seals, decals and/or nameplate shall be attached to and visible on all equipment.
- C. Items such as motors, starting equipment, vibration isolating devices, and all other equipment and material, where applicable and practicable, must each be of one manufacturer.
- D. Install equipment in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. Obtain these instructions, which will be considered part of these specifications. Type, capacity and application of equipment must be suitable and operate satisfactorily for the purpose intended in the HVAC systems.

2.3 INSERTS, HANGER SUPPORTS, CLAMPS, FASTENINGS

- A. All materials, designs and types of inserts, hanger supports and clamps must meet the requirements of the latest edition of the Manufacturers Standardization Society Document MSS-SP-58, Underwriters Laboratories, Inc., National Electrical Code and Factory Mutual Engineering Division Standards where applicable. Insert, hanger support and clamp types referenced herein are shown in MSS-SP-58.
- B. Provide all necessary inserts, hanger supports, fastenings, clamps and attachments necessary for support of the HVAC work. Select the types of all inserts, hanger supports, fastenings, clamps and attachments to suit both new and existing building construction conditions specifically for the purposes intended.

2.4 SMOKE/FIRESTOPPING (MATERIALS)

- A. Firestopping materials and systems must consist of commercially manufactured products complying with the following minimum requirements and be asbestos and PCB free:
 - 1. Flame Spread Index: Twenty-five or less when tested in accordance with ASTM E 84.
 - 2. Smoke Density Index: Fifty or less when tested in accordance with ASTM E 84.
 - 3. Nontoxicity: Nontoxic to human beings at all stages of application and during fire conditions.
 - 4. Systems shall comply with Underwriter's Laboratory Listing Requirements.
 - 5. Fire Resistance:

- a. Materials and systems used to seal penetrations in time rated assemblies must be capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 time temperature fire conditions for 3 hours.
 - b. Materials must not require a rise in temperature to install or activate seal.
 - c. Materials must not contain solvents or require hazardous waste disposal.
 - d. Firestop material must not dissolve in water after curing.
- B. Basis of Design for smoke and firestopping materials is Rectorshield, Inc. Comparable product by Hilti, or 3M may be submitted for review.
- C. Smoke stopping materials must be approved by the authority having jurisdiction.

PART 3 - EXECUTION

3.1 METHOD OF PROCEDURE

- A. The drawings accompanying these specifications are diagrammatic and intended to cover the approximate and relative locations of the building systems.
- B. Installation, connection and interconnection of all components of these systems must be complete and made in accordance with the manufacturers' instructions and best trade practices.
- C. Erect all parts of equipment furnished at such time and in such manner as not to delay or interfere with other Trade Contractors and their work.
- D. Before material is ordered or fabricated, or any work is performed, verify all calculations, sizing, measurements, including lines, grades, conduit and ductwork elevations at the building, as applicable, and be responsible for the correctness thereof. No extra compensation will be allowed on account of differences between actual dimensions, routing and measurements and those indicated in the Contract Documents. Any discrepancies discovered must be submitted to the Engineer for consideration before proceeding with the work.
- E. Lay out work and be responsible for the establishment of heights, grades, and the like, for all interior and exterior equipment and systems as applicable, including fixtures, conduit, ductwork, and the like, included in Contract Documents, in strict accordance with the intent expressed thereby; and all the physical conditions to be met at the building and finished grade, and be responsible for accuracy thereof. The establishment of the location of all work must be performed in consideration of the finished work. In case of conflict, equipment and/or materials must be relocated without cost to the Project, as directed by the Engineer, regardless of which equipment was installed first. Refer to Article, "Coordination Drawings", in Part 1 of this section.
- F. Cooperate with other Trade Contractors for the proper securing and anchoring of all work included within these specifications. Use extraordinary care in the erection and installation of all equipment and materials to avoid marring surfaces of the work of other Trade Contractors, as each Trade Contractor will be held financially responsible for all such injury caused by the lack of precaution and due to negligence on the part of the Trade Contractor's work force.

- G. All ductwork, conduit and other materials and equipment shown to be mounted below ceilings are to be kept as close to ceiling areas as possible unless otherwise noted.
- H. Install and arrange all equipment, such as dampers, junction boxes, and the like, which will be concealed in construction, to be fully accessible for adjustment, service and maintenance. Furnish access doors where required for installation under the General Construction Contract, where applicable. Otherwise, furnish and install all required access doors.

3.2 PROTECTION OF WORK

- A. Exercise every precaution to exclude dust, dirt and all other foreign materials from switchgear rooms, transformers, and all mechanical equipment rooms during construction. Rooms and equipment contained therein must be swept and vacuum cleaned at regular intervals. All relays, meters and HVAC equipment containing electrical components must be protected with heavy paper held in place with approved mastic tape to exclude fine dust and particles. Install and maintain sufficient electric heaters in equipment rooms and transformer compartments to keep equipment dry during construction.

3.3 CUTTING AND PATCHING

- A. New Construction:
 - 1. Perform cutting and patching in accordance with Division 01.
 - 2. Provide and set all sleeves, inserts and other items required for the installation of the HVAC work, and take responsibility for their final and permanent locations.
 - 3. Confer with, and give the General Construction Trade Contractor, where applicable, complete information as to size of openings in all construction, so that such openings may be provided as the building progresses. Otherwise, provide openings as required for the HVAC work.
 - 4. If openings are omitted or incorrect through failure to follow these instructions the particular Trade Contractor must, at no additional cost to the project, engage the trade which originally installed the work to cut and patch to the satisfaction of the Engineer.
- B. For existing construction:
 - 1. The General Construction Trade Contractor, where applicable, will perform all cutting and patching required for the work of all trades. Otherwise, all Trade Contractors are responsible for their own cutting and patching.

3.4 CONCRETE AND MASONRY

- A. Provide all cast-in-place concrete, pre-cast concrete and masonry work (brick and block) required for completion of the HVAC work, including interior and exterior concrete slabs.
- B. Engineer will review and approve materials used.
- C. Unless shown or specified otherwise, all equipment foundations and housekeeping pads must be six inches (6") minimum height from floor, of sufficient mass, and secured to the floor.

- D. Refer to Division 03 for concrete specifications.
- E. Unless noted otherwise, concrete bases must be 4" larger than the largest dimension of the base of the supported equipment in both directions. Use 3000 psi, 28 day compressive strength concrete and reinforcement.

3.5 SUPPORTS

- A. Except where noted otherwise in the specifications and shown on drawings, provide all materials, including, but not limited to, equipment supports, supplies and labor necessary as required to adequately support, brace and strengthen new and/or existing equipment and materials installed under/or affected by the HVAC work.
- B. The design, materials, fabrication and erection of structural steel supports must conform to "Specification for Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, "Code of Standard Practice for Steel Buildings and Bridges". Welding, where required, must conform to "Code of Arc and Gas Welding in Building Construction" of the American Welding Society.

3.6 LINTELS

- A. Lintel work to be performed in strict accordance with Division 01, and Architectural and Structural drawings. Refer to Architectural and Structural Contract Documents for lintel schedules and details.
- B. Where lintels are not indicated as being provided by General Construction or Structural Trade Contractors, the HVAC Trade Contractor must provide lintels required for the installation and completion of HVAC work.

3.7 MACHINERY GUARDS

- A. Provide OSHA approved expanded sheet steel metal guards over all belt drives, couplings and other moving equipment to protect personnel from injury.
- B. Machinery guards shall comply with OSHA Standards 29 CFR STANDARD NUMBER 1910.212 General Requirements for all Machines; Subpart Number 0; Subtitle - Machinery and Machine Guarding; STANDARD NUMBER 1910.219; Standard Title - Mechanical Power - Transmission Apparatus; Subpart Number 0; Subpart Title - Machinery and Machine Guarding.

3.8 PAINTING AND FINISHING

- A. All painting, generally, will be provided by the General Construction Trade Contractor, where applicable, except where specifically noted otherwise in the HVAC Specifications. Otherwise, all Trade Contractors are responsible for their own painting and finishing.
- B. Equipment and material furnished with factory enamel finish will not be painted unless finish has been damaged, in which case the equipment or material must be refinished by the Trade Contractor who furnished it, to the satisfaction of the Engineer.

3.9 LUBRICATION

- A. Provide proper and necessary lubrication of any items of operating, rotating or moving equipment which is furnished, installed or which must operate as part of the HVAC system.
- B. When an item of operating equipment is furnished and installed by a Trade Contractor, it will be that Trade Contractor's responsibility to accomplish the lubrication.
- C. When an item of operating equipment is furnished by one Trade Contractor and installed by another, it is the responsibility of the Trade Contractor furnishing the equipment to apply the lubricants.
- D. All rotating or moving equipment must be lubricated prior to energizing and operating the equipment. Should the Trade Contractor responsible for the lubrication fail to apply lubricants prior to initial start-up and the equipment is damaged as a result of that Trade Contractor's negligence, that Trade Contractor is required to provide all corrective action necessary including replacement, if required, for the proper operation of equipment.
- E. Lubrication must be accomplished in the manner prescribed or recommended by the manufacturer of the specific item. For motor driven equipment this precaution of lubrication will apply individually to the driver and the driven component.
- F. The lubricants must be of the type, grade, specification and manufacture as prescribed or recommended by the manufacturer of the specific equipment item.
- G. Extend lubrication fittings where required to allow maintenance personnel to lubricate the equipment easily and efficiently.
- H. The Trade Contractor who supplies any item of rotating equipment will have the responsibility of securing written instructions on the lubricating procedure and must furnish not less than one year's supply of all necessary lubricants properly identified so they can be replaced.

3.10 HVAC TRADE - ELECTRICAL TRADE COORDINATION

- A. Furnish equipment with electrical current characteristics as shown on electrical drawings and specifications.
- B. The nameplate voltage of all motors furnished with mechanical equipment must be within the range of the voltage shown for use with the motor as the upper limit, and 5% less than this voltage as the lower limit.
- C. HVAC Trade Contractor must furnish all motors, motor starters, specialty motor controllers, float and pressure switches, temperature control, other special automatic controls as indicated in the Contract Documents for all equipment furnished and/or installed under the HVAC contract except where noted otherwise.
- D. All electrical equipment furnished by the HVAC Trade Contractor must be as recommended by the equipment manufacturers, in accordance with the Electrical Specifications for similar items, and of such type as to work properly with automatic temperature control sequences where required.

- E. The Electrical Trade Contractor will provide all push-buttons, safety switches for motors, and wiring from starters to motors and install all starters furnished to him by the HVAC Trade Contractor unless otherwise indicated in the Contract Documents.
- F. Where controllers and/or starters are furnished as an integral part of any equipment, the Trade Contractor supplying the equipment must furnish complete wiring between controllers, starters and motors.
- G. The Electrical Trade Contractor must provide disconnect switches for all equipment furnished and/or installed by other Trade Contractors, except where such switches are an integral part of equipment.
- H. HVAC Trade Contractor must set all motors and furnish, set and pipe as necessary, float switches, temperature control and other special automatic temperature controls.
- I. HVAC Trade Contractor must provide all power and control wiring required by the respective sections of the specifications. The Electrical Trade Contractor will provide all other wiring required for the completion of the work of the HVAC Trade Contractor.
- J. HVAC Trade Contractor must furnish the Electrical Trade Contractor with complete wiring diagrams as required.
- K. Any electrical work performed by the HVAC Trade Contractor must be performed in accordance with the requirements of the ELECTRICAL Section of these specifications.

3.11 ELECTRICAL MOTORS AND STARTERS

- A. All motors furnished by all Trade Contractors, unless specified to the contrary in Contract Documents, must conform to the following requirements:
 - 1. Characteristics, dimensions, tolerances, temperature rise, insulation, rating, noise, vibration, and all other characteristics in accordance with the latest standards of IEEE or NEMA.
 - 2. Unless required by the driven unit, motors must have normal starting torque, NEMA Design B characteristics. Horsepower rating of motor must be equal to or greater than that required by driven equipment. Current density design of motor rating must be limited so that overload protection provided by standard motor starters will be adequate to prevent damaging overheating during stall, single phasing or slightly prolonged acceleration.
 - 3. Use NEMA Class A or B insulation with motor frames amply sized to provide a 1.15 service factor at an ambient of 40 deg. C maximum. Insulation systems must be designed for an average life of 60,000 hours.
 - 4. All motors must be high efficiency. Meet or exceed requirements in NEMA Standard MG1, Table 12-10.
 - 5. Each motor must be mounted on the same bedplate as the equipment driven and be complete with pulleys, slide rails or flexible couplings as required.
 - 6. Each Trade Contractor is responsible in each instance for the proper selection of motors of suitable characteristics with details submitted for approval to the Engineer prior to installation.

- B. All starters furnished by all Trade Contractors must conform with the following requirements, unless specified to the contrary in the Contract Documents:
1. All starters for 3-phase equipment must be fully enclosed, across-the-line type equipped with solid state overload protection as herein specified for all three phases, low voltage protection, all necessary auxiliary contacts as required and indicating pilot lights. Starters which are controlled automatically must have two-wire control with "ON-OFF-AUTO" switches. Starters which are controlled manually must have 3-wire control with Start-Stop pushbuttons.
 2. All 3-phase starters remotely controlled must have 120 volt coils and control transformers with disconnecting means. Starters for single phase motors shall be manual toggle switches with thermal overload protection and pilot light. Omit pilot light for unit heaters.
 3. General Purpose NEMA-1 enclosure for indoor use under normal atmospheric conditions. Watertight enclosure NEMA-4 or NEMA-5 for outdoor use or where starters are subjected to the splashing or dripping of water. Explosion-proof enclosure NEMA-7, 9 or 12 for dusty or hazardous locations as required by Article 500 of the National Electrical Code.
 4. Individually equip all starters for three phase motors with solid state adjustable overload protection with automatic protection to prevent single phase operation with the following features:
 - a. Three phase, self-powered with current sensing, phase unbalance and phase loss protection, visible trip indication, trip test function, and power "LED."
 - b. Phase loss protection to include automatic restart with a selectable manual switch.
- C. All controllers, starters and other electrical components furnished as an integral part of any apparatus must be furnished complete with integral wiring as required.
- D. So far as is practical, all motors and starters must be of one manufacturer. Basis of Design: General Electric Co. Comparable products by Westinghouse Co., Square-D Co., or Allen-Bradley Co. may be submitted for review.
- E. Submittals for motors and starters must be coordinated with Electrical Trade Contractor.

3.12 REMOVAL AND RELOCATION

- A. Perform all, removal and relocation work required for completion of HVAC systems.
- B. Removals shown on drawings are a general indication only, and may not necessarily indicate the full extent of removals which may be required to complete this work.
- C. Where existing partitions, walls, ceilings and floors are to be removed, all ducts, piping, conduits, materials and equipment attached or fastened thereto or within, as applicable, must be carefully removed.
- D. Where work under this contract interferes with the existing construction, ductwork, piping, conduit or equipment, remove all such materials and route new work to clear the obstruction. Provide additional piping, conduits, ducts, and material of the same design and quality if the piping and/or conduit is to be continued in use.

- E. Disconnect and remove all accessible piping, conduit, ductwork, materials, fixtures and equipment not required in the new systems. Plug all outlets at the main or riser connection.
- F. Removed materials not desired by the Owner and not to be reset and not specified nor indicated to be reused, become the property of the HVAC Trade Contractor and must be promptly removed from site.
- G. All demolition work is subject to the direction and approval of the Engineer and must be performed in such manner as not to interfere with the normal operation of the building.
- H. Relocate existing utilities and/or equipment that must remain to maintain operation of building or parts of building outside the work area.

3.13 SMOKE AND FIRESTOPPING (METHODS)

- A. Installation of materials must be performed by applicator/installers qualified, trained and approved by the manufacturer of the materials, and be installed in accordance with ASTM E 814.
- B. Install smoke and firestopping at locations required, shown, or specified in accordance with applicable codes, manufacturer's written instructions, and test report, applying to the specific trade equipment as applicable. Cutting and patching of construction and providing sleeves, where required, is shown on drawings or specified in other sections.
 - 1. Filling of Voids: Smoke and firestopping materials must completely fill void spaces regardless of geometric configuration, subject to tolerances established by the manufacturer. Smoke and firestopping for filling voids in floors in which the smallest dimension of the void is 4 in. or more must support the same load as the floor is designed to support or must be protected by a permanent barrier to prevent loading or traffic in the smoke or firestopped areas.
 - 2. Insulated Ductwork and Pipes: Insulated equipment penetrating rated floors and walls must be insulated with materials which provide the same performance as the smoke and firestopping material. This material must extend a minimum of 6 in. on each side of the opening. Vapor barrier of such insulation must have a perm rating of 0.03 maximum.
 - 3. Electrical Cables or Conduits: Smoke and firestopping at penetrations of electrical cables or conduits must comply with the requirements of NFPA 70.
 - 4. Where smoke and firestopping of penetrations in floors, walls and partitions that will be exposed in completed construction, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and provide escutcheons or other trim.
 - 5. Schedule the installation and required inspection of smoke and firestops for penetrations that will be concealed in completed construction prior to erection of floors, walls, and partitions that would permanently conceal the penetrations.
- C. All areas of smoke and firestopping installation must be accessible until inspection by the applicable code authorities.

3.14 CONCRETE PATCHING (PROCEDURE)

- A. Remove any loose debris, chipped or cracked portions of concrete, and any grease, oil, dirt or other coating materials from the concrete to be patched.
- B. Apply epoxy bonding adhesive to the clean dry surface with a brush or roller to briefly flood the surface allowing good penetration, if completely absorbed, apply additional material. Adhesive Basis of Design: Edison Coatings Inc. Flexi-Bond 540. Comparable product by Sika Corp. or Euclid Chemical Co. may be submitted for review. Refer to Division 03 of these specifications.
- C. Apply new cementitious mortar patch to surface immediately after applying bonding adhesive, bonding agent should be wet while applying concrete patch. Mortar patch equal to Moxie International 2000 Super Patch. Comparable product by Sika Corp. or Euclid Chemical Co. may be submitted for review. Refer to Division 03 of these specifications.
- D. Work patch into any cracks or crevices with a brush, then apply remainder of patch and trowel until level and smooth.
- E. Do not apply patch below 45 deg. F.

3.15 INITIAL APPLICATION FOR PAYMENT

- A. Provide the following prior to submitting the initial application for payment:
 - 1. Copy of the HVAC Trade Contractor's and Sub-Contractors' licenses for the state in which the work is being performed.
 - 2. Resumes for the designated Project Manager and Project Foreman.
 - 3. List of independent agencies who will be engaged by the HVAC Trade Contractor to perform tests, provide certifications, conduct inspections, etc. as required by Contract Documents.
- B. The initial application for payment will not be processed until the items above are submitted.

3.16 FINAL APPLICATION FOR PAYMENT

- A. Provide the following prior to submitting the final application for payment:
 - 1. Refer to Division 01 of these specifications.
 - 2. Duct Leakage Test Report.
 - 3. Pipe Pressure Test Reports.
 - 4. Equipment Start-Up Reports for each piece of HVAC equipment.
 - 5. Operation and Maintenance Manuals and Data.
 - 6. Automatic Temperature Control System Commissioning Report.
 - 7. Testing, Adjusting and Balancing Report for HVAC systems.
 - 8. HVAC system and equipment warranties.
 - 9. HVAC Contractor's Punch List of incomplete work items with reason why each work item is not complete and anticipated schedule for completion. Submit at least one week prior to Engineer's final Construction Observation Report site visit.
 - 10. HVAC Trade Contractor's notarized certification letter.

11. As-built drawings.

B. Final payment is contingent upon completion of all items listed above.

END OF SECTION 230010

SECTION 230533 - HEAT TRACING FOR HVAC PIPING

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 heat tracing for existing HVAC piping on level B of the Parking Garage.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
 - 2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
- B. Shop Drawings: For electric heating cable.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years for the heat trace cables and 2 year for the controllers from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HEATING CABLES

- A. Products shall be as manufactured by one of the following (Basis of design: NVent: XL-Trace):
 1. nVent: Raychem.
 2. Delta-Therm Corporation.
 3. Orbit Manufacturing.
- B. Comply with IEEE 515.1.
- C. Heating Element: Nickel plated copper bus wire with self-regulating conductive core, modified polyolefin inner jacket, tinned copper braid, Modified polyolefin outer jacket.
- D. Powered Connection Kits – Waterproof, UV-resistant enclosure. Kit includes 5' power lead wires, a conduit fitting; pipe mounting bracket and end seal. The kits shall be for one, two or three heating cables. Basis of design: NVent RayClic.
- E. Heat-Tracing Control System:
 1. Provides accurate temperature control with integrated 30-mA ground fault protection.
 2. One for each Heat trace circuit with NEMA 4X enclosure.
 3. Controller includes window and a digital display showing measured temperature, set point temperature and alarm conditions along with a dry contact for alarm annunciation back to the building management system.
 4. The controller shall be set to monitor an alarm for high and low temperature, low current, and ground fault level.
- F. Maximum Fluid Operating Temperature: <100 deg F (chilled water and condenser water systems)
- G. Maximum Fluid Operating Temperature: <220 deg F (heating hot water system)
- H. Maximum Ambient Temperature: 120 deg F.
- I. Minimum Ambient Temperature: 0 deg F.
- J. Relative Humidity: 0 to 90%, non-condensing.
- K. Control: On/Off via line Sensor. Energize heat trace at pipe temperature drops below 40 deg F. De-energize the heat trace when the pipe temperature rises above 42 degrees F.
- L. 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.

2.2 ACCESSORIES

- A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
- B. Glass tape for attaching heating cable to pipe.
- C. Piping Warning Labels: "Electric Traced" label for identifying traced pipes, valves and fittings. Refer to applicable Division 23 Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions. Prep existing surfaces in accordance with the manufacture's recommendation.
- A. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Coordinate installation of the heat tracing with the piping insulation removal and new insulation.

3.2 INSTALLATION

- A. Install electric heating cable across expansion joints according to manufacturer's written instructions; use slack cable to allow movement without damage to cable.
- B. Install electric heating cables after piping has been tested and before insulation is installed.
- C. Install electric heating cables according to IEEE 515.1.
- D. Install insulation over piping with electric cables according to Section 230719 "HVAC Piping Insulation."
- E. Install warning labels every 10 ft on piping insulation where piping is equipped with electric heating cables.
- F. Set field-adjustable switches and circuit-breaker trip ranges.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
 - 1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
 - 2. Test cables for electrical continuity and insulation integrity before energizing.
 - 3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
- C. Cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 PROTECTION

- A. Protect installed heating cables, including non-heating leads, from damage during construction.
- B. Remove and replace damaged heat-tracing cables.

END OF SECTION 230533

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Warning signs and labels.
2. Equipment labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
2. Letter and Background Color: As indicated for specific application under Part 3.
3. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/2 inch.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
- B. Letter and Background Color: As indicated for specific application under Part 3.

- C. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
- D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- E. Minimum Letter Size: 1/2 inch.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.3 PIPE LABELS (for existing Parking Garage level B piping)

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.
- B. Letter and Background Color: As indicated for specific application under Part 3.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
 - 1. System and either supply or return
 - 2. Pipe size.
 - 3. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
 - 4. Lettering Size: 1/2 inch.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

- A. Permanently fasten labels on each item of mechanical equipment.
- B. Sign and Label Colors:
 - 1. White letters on an ANSI Z535.1 safety-blue background.
- C. Locate equipment labels where accessible and visible.

3.4 INSTALLATION OF PIPE LABELS

- A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
- B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Spaced at maximum intervals of 20 ft. along each run.
- C. Flow-Direction Arrows: Use arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe-Label Color Schedule:
 - 1. Chilled-Water Piping: White letters on an ANSI Z535.1 safety-green background.
 - 2. Condenser-Water Piping: White letters on an ANSI Z535.1 safety-green background.
 - 3. Heating Water Piping: White letters on an ANSI Z535.1 safety-green background.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Testing, Adjusting, and Balancing of Air Systems:
 - a. Constant-volume air systems.
 - b. Exhaust fans.
 - c. Unit heaters.
- 2. Testing, adjusting, and balancing of equipment.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within **60** days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Certified TAB reports.
- C. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.

4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications, Certified by AABC or NEBB:
 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine the approved submittals for HVAC systems and equipment.
- C. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- D. Examine equipment performance data, including fan curves.
 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- F. Examine test reports specified in individual system and equipment Sections.
- G. Examine operating safety interlocks and controls on HVAC equipment.
- H. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
- I. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Fans are operating, free of vibration, and rotating in correct direction.
 - d. Automatic temperature-control systems are operational.
 - e. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" and ASHRAE 111 and in this Section.
- B. Cut insulation, ducts, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.
- C. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

- A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
 - 1. Fans
 - 2. Unit heaters.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' Record drawings duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check dampers for proper position to achieve desired airflow path.
- G. Check for airflow blockages.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - 3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
- B. Verify final system conditions.
 - 1. Re-measure and confirm that total airflow is within design.
 - 2. Re-measure all final fan operating data, speed, volts, amps, and static profile.
 - 3. Record final fan-performance data.

3.7 HVAC CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
 - 1. Verify HVAC control system is operating within the design limitations.
 - 2. Confirm that the sequences of operation are in compliance with Contract Documents.
 - 3. Verify that controllers are calibrated and function as intended.
 - 4. Verify that controller set points are as indicated.
 - 5. Verify the operation of lockout or interlock systems.
 - 6. Verify the operation of damper actuators.

7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature.

- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.8 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Exhaust Fans: Plus 10 percent or minus 5 percent.

3.9 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

- B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

- C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Engineer's name and address.
6. Contractor's name and address.
7. Report date.
8. Signature of TAB supervisor who certifies the report.
9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
10. Summary of contents, including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.

- c. Description of system operation sequence if it varies from the Contract Documents.
 - 11. Nomenclature sheets for each item of equipment.
- D. Electric-Coil Test Reports: For electric unit heaters include the following:
 - 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Capacity in Btu/h.
 - d. Number of stages.
 - e. Connected volts, phase, and hertz.
 - f. Rated amperage.
 - g. Airflow rate in cfm.
 - h. Face area in sq. ft..
 - i. Minimum face velocity in fpm.
 - 2. Test Data (Indicated and Actual Values):
 - a. Heat output in Btu/h.
 - b. Airflow rate in cfm.
 - c. Air velocity in fpm.
 - d. Entering-air temperature in deg F.
 - e. Leaving-air temperature in deg F.
 - f. Voltage at each connection.
 - g. Amperage for each phase.
- E. Fan Test Reports: For exhaust fans, include the following:
 - 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and speed.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.

- b. Total system static pressure in inches wg.
- c. Fan speed.
- d. Discharge static pressure in inches wg.
- e. Suction static pressure in inches wg.

F. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.10 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
- B. Prepare test and inspection reports.

END OF SECTION 230593

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulation for HVAC piping systems.
- B. Related Requirements:

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at elbows, fittings, flanges, and specialties for each type of insulation.
 - 4. Detail application of field-applied jackets.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program, certified by the Department of Labor, Bureau of Apprenticeship and Training.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of manufacturer, fabricator, type, description, and size.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in applicable Division 23 Sections.
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
 - 1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," and "Outdoor, Aboveground Piping Insulation Schedule," articles for where insulating materials are applied.
- B. Products do not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
- F. Calcium Silicate: Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C533, Type I.

1. Prefabricated Fitting Covers: Comply with ASTM C450 and ASTM C585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Johns Manville; a Berkshire Hathaway company.
 - 2) Knauf Insulation.
 - 3) Manson Insulation Inc.
- G. Mineral Fiber, Preformed Pipe: bonded with a water repellent thermosetting resin. Comply with ASTM C547.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Manson Insulation Inc.
 2. Preformed Pipe Insulation: Type II, Grade A with factory-applied ASJ-SSL.
 3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.

2.3 INSULATING CEMENTS

- A. Mineral Fiber Insulating Cement: Comply with ASTM C195.

2.4 ADHESIVES

- A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

2.5 MASTICS

- A. Materials are compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
 2. Service Temperature Range: 0 to plus 180 deg F.

2.6 LAGGING ADHESIVES

- A. Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.
 - 1. Service Temperature Range: 20 to plus 180 deg F.
 - 2. Color: White.

2.7 SEALANTS

- A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.
- B. Joint Sealants:
 - 1. Permanently flexible, elastomeric sealant.
 - a. Service Temperature Range: Minus 150 to plus 250 deg F.
 - b. Color: White or gray.

2.8 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.
- B. Metal Jacket:
 - 1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Outdoor Applications: 53-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.

- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 SECUREMENTS

A. Bands:

1. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
2. Springs: Twin spring set constructed of stainless steel, with ends flat and slotted to accept metal bands. Spring size is determined by manufacturer for application.

B. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 1. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
- D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
 - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 2 inches o.c.
 - 4. For below-ambient services, apply vapor-barrier mastic over staples.
 - 5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.

6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Wall Penetrations: Install insulation up tight to wall penetrations.
 1. Terminate insulation inside wall surface and seal with joint sealant.
 2. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation up tight to floor penetrations.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.
- B. Insulation Installation on Fittings, Flanges, Mechanical Couplings, and Unions:
 1. Install insulation over fittings, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using prefabricated fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
 4. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

3.7 INSTALLATION OF FIELD-APPLIED JACKETS

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

- A. Do not field paint aluminum jackets.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections: Inspect pipe, and fittings, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to one location. of straight pipe, for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.
- B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE (Exg. exposed piping on level B of the unconditioned Parking Garage routed between columns F and H).

- A. Chilled Water Supply and Return:
 - 1. All Pipe Sizes: Insulation is the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 3 inches thick.
- B. Condenser-Water Supply and Return:
 - 1. All Pipe Sizes: Insulation is the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
- C. Heating-Hot-Water Supply and Return:
 - 1. All Pipe Sizes: Insulation is the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE (Exg. exposed piping on level B of the unconditioned Parking Garage routed between columns F and H).

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed:

1. Aluminum, Smooth: 0.032 inch thick.

END OF SECTION 230719

SECTION 230900 – CONTROLS SYSTEM EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building Management System (BMS), utilizing direct digital controls.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Products Supplied but Not Installed Under This Section:

1. Space temperature sensors (3).
2. Natural gas pressure sensor (2).
3. Motor operated dampers (insulated where noted on the drawings).
4. Current switches (2).

- B. Products Installed but Not Supplied Under This Section:

1. None.

- C. Products Not Furnished or Installed but Integrated with the Work of This Section:

1. High and low temperature in the fire pump rooms and Level C mechanical room.
2. Operation of the motor operated dampers.
3. Proof of exhaust fan operation (2).
4. Pre-action system air compressors (3) – general alarms.
5. Heat Trace (6) – general alarms.
6. Emergency generator (2) – low gas pressure alarm.
7. Sump Pump (2) – general alarm

1.3 SYSTEM DESCRIPTION

- A. Scope: Furnish all labor, materials and equipment necessary for a complete and operating Expansion to the Existing Honeywell Building Management System (BMS), located at The Government Center Building at Delaware county, utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. All new controllers provided in this section (Honeywell, JACE 8000, etc.) shall communicate on a peer-to-peer bus over an open protocol bus of MS/TP BACnet, Ethernet or Modbus and communicate fully with the existing BMS as described herein. New Tridium “JACE” controllers installed under this project shall be loaded with the Niagara AX framework version currently being used by the existing Honeywell server and communicate fully. Provide an ethernet drop (from current router) for all new Niagara AX Framework controllers installed under this project and connect from new JACE controller to the existing Honeywell XL 5000 server.

1. The intent of this specification is to provide a system that is consistent with existing BMS systems throughout the owner's facilities running the Niagara AX, or Niagara

- 3.xx Framework (matching the version currently loaded on the existing BMS Server).
 2. System architecture shall fully support a multi-vendor environment and be able to integrate third party systems via existing vendor protocols including, as a minimum, LonTalk, BACnet and Modbus.
 3. System architecture shall provide secure Web access using MS Internet Explorer from any computer on the owner's LAN.
 4. All control devices, existing and furnished with this Section shall be programmable directly from the Niagara AX Workbench upon completion of this project. The use of configurable or programmable controllers that require additional software tools for post-installation maintenance shall not be acceptable.
 5. Any control vendor that shall provide additional BMS server software shall be unacceptable. Only systems that utilize the Niagara AX Framework shall satisfy the requirements of this specification section.
 6. The existing BMS server shall host all graphic files for the Facility control system. All graphics and navigation schemes for this project shall match those that are on the existing campus Niagara AX Framework server located in the Government Center Building.
 7. All JACE hardware products used on this project shall be made in the USA.
- B. All products of the BMS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided on request, with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
1. Federal Communications Commission (FCC), Rules and Regulations, Volume II -July 1986 Part 15 Class A Radio Frequency Devices.
 2. FCC, Part 15, Subpart J, Class A Computing Devices.
 3. UL 504 - Industrial Control Equipment.
 4. UL 506 - Specialty Transformers.
 5. UL 910 - Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables Used in Air-Handling Spaces.
 6. UL 916 - Energy Management Systems All.
 7. UL 1449 - Transient Voltage Suppression.
 8. Standard Test for Flame Propagation Height of Electrical and Optical - Fiber Cables Installed Vertically in Shafts.
 9. EIA/ANSI 232-E - Interface Between Data Technical Equipment and Data Circuit Terminal Equipment Employing Serial Binary Data Interchange.
 10. EIA 455 - Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices.
 11. IEEE C62.41- Surge Voltages in Low-Voltage AC Power Circuits.
 12. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - a. NEMA 250 - Enclosures for Electrical Equipment.
 13. NEMA ICS 1 - Industrial Controls and Systems.
 14. NEMA ST 1 - Specialty Transformers.
 15. NCSBC Compliance, Energy: Performance of control system shall meet or surpass the requirements of ASHRAE/IESNA 90.1-1999.

1.4 SUBMITTALS

- A. 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.
- B. Submit documentation of contractor qualifications, including those indicated in "Quality Assurance" if requested by the A-E.
- C. 2 copies of shop drawings of the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers' catalog data sheets and installation instructions. Submit in printed electronic format. Samples of written Controller Checkout Sheets and Performance Verification Procedures for applications similar in scope shall be included for approval.
- D. Shop drawings shall also contain complete wiring and schematic diagrams, control system bus layout and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.
- E. Upon completion of the work, provide two (2) complete sets of 'as-built' drawings and other project-specific documentation in 3-ring hard-backed binders and on Flash media.
- F. Any deviations from these specifications or the work indicated on the drawings shall be clearly identified in the As-Built Drawings.
- G. Submittal shall consist of:
 - 1. System architecture showing all digital devices.
 - 2. Equipment lists of all proposed devices and equipment including data sheets of all products, including third party equipment.
 - 3. Wiring and piping interconnection diagrams including panel and device power and sources, including third party diagrams, with terminal point designation for each wire connection.
- H. Wiring diagrams detailing wiring for power, signal, and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.

1.5 QUALITY ASSURANCE

- A. The Control System Contractor shall have a full service DDC office within 50 miles of the job site. This office shall be staffed with applications engineers, software engineers and field technicians. This office shall maintain parts inventory and shall have all testing and diagnostic equipment necessary to support this work, as well as staff trained in the use of this equipment.
- B. Single Source Responsibility of Supplier: The Control System Contractor shall be responsible for the complete installation and proper operation of the control system. The Control System Contractor shall exclusively be in the regular and customary business of design, installation and service of computerized building management systems similar in

size and complexity to the system specified. The Control System Contractor shall be the manufacturer of the primary DDC system components or shall have been the authorized representative for the primary DDC components manufacturer for at least 5 years. All control panels shall be assembled by the Control System Contractor in a UL-Certified 508A panel shop.

- C. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in the production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

1.6 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Maintain integrity of shipping cartons for each piece of equipment and control device through shipping, storage and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.8 JOB CONDITIONS

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other trades in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers and structural and architectural features.

1.9 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Honeywell Building Control Systems.
- B. Substitutions: Not permitted.
- C. The existing Automatic Temperature Control System is by Honeywell and coordinate with DELCO's Controls contractor.

2.2 GENERAL

- A. The Building Management System expansion (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a network area controller, graphics and programming and other control devices for a complete system as specified herein.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall BMS and existing BMS.

2.3 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURE

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system utilizing Open protocols in one open, interoperable system, interfacing with the existing Honeywell BMS located at the Government Center.
- B. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- C. Standard Client: The thin-client Web Browser BAS GUI shall be Microsoft Internet Explorer (10.0 or later) running on Microsoft Windows 10. No special software shall be required to be installed on the PCs used to access the BAS via a web browser.

2.4 SYSTEM NETWORK CONTROLLER (SNC)

- A. These controllers are designed to manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC) and advanced unitary controllers (AUC) which are connected to its communications trunks, manage communications between itself and other system network controllers (SNC) and with any operator workstations (OWS) that are part of the BAS, and perform control operating strategies for the system based on information from any controller connected to the BAS.
- B. The controllers shall be fully programmable to meet the unique requirements of the facility it shall control.
- C. The controllers shall be capable of peer-to-peer communications with other SNC's and with any OWS connected to the BAS, whether the OWS is directly connected, connected via modem or connected via the Internet. Controllers shall all use a compatible version of the Niagara AX framework as currently installed on the existing Honeywell BMS server.
- D. The communication protocols utilized for peer-to-peer communications between SNC's will be Niagara AX, BACnet TCP/IP and SNMP. Use of a proprietary communication protocol for peer-to-peer communications between SNC's is not allowed.
- E. The SNC shall be capable of executing application control programs to provide:
 - 1. Calendar functions.
 - 2. Scheduling.
 - 3. Trending.
 - 4. Alarm monitoring and routing.

5. Time synchronization.
 6. Integration of LonWorks, BACnet, and ModBus controller data.
 7. Network management functions for all SNC, PEC and ASC based devices.
- F. The SNC shall provide the following hardware features as a minimum:
1. One Ethernet Port-10/100 Mdns.
 2. One RS-232/485 port.
 3. One LonWorks Interface Port - 78KB FTT-10A.
 4. Battery Backup.
 5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller shall contain a hard disk with at least 1 gigabyte storage capacity).
- G. The SNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
- H. The SNC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.
- I. The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
 - a. Alarm.
 - b. Return to normal.
 - c. To default.
 2. Alarms shall be annunciated in any of the following manners as defined by the user:
 - a. Screen message text.
 - b. Email of complete alarm message to multiple recipients.
 - c. Pagers via paging services that initiate a page on receipt of email message.
 - d. Graphics with flashing alarm object(s).
 3. The following shall be recorded by the SNC for each alarm (at a minimum):
 - a. Time and date.
 - b. Equipment (air handler #, access way, etc.).
 - c. Acknowledge time, date, and user who issued acknowledgement.
- J. Programming software (Niagara AX Workbench) and all controller "Setup Wizards" shall be embedded into the SNC.

2.5 OTHER CONTROL SYSTEM HARDWARE

- A. Motorized control dampers that will not be integral to the equipment shall be furnished by

the Control System Contractor. Control damper frames shall be constructed of galvanized steel, formed into channels and welded or riveted. Dampers shall be galvanized, with nylon bearings. Blade edge seals shall be vinyl. Blade edge and tip seals shall be included for all dampers. Blades shall be 16-gauge minimum and 6 inches wide maximum and frame shall be of welded channel iron. Damper leakage shall not exceed 10 CFM per square foot, at 1.5 inches water gauge static pressure. Dampers shall be insulated where noted on the drawings. Motor operated dampers shall be same size as louvers.

- B. Control damper actuators shall be furnished by the Control System Contractor. Two-position or proportional electric actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be spring return type. Operators shall be heavy-duty electronic type for positioning automatic dampers in response to a control signal. Motor shall be of sufficient size to operate damper positively and smoothly to obtain correct sequence as indicated. All applications requiring proportional operation shall utilize truly proportional electric actuators.
- C. Wall Mount Room Temperature sensors: Each room temperature sensor shall provide temperature indication to the digital controller, provide the capability for a software-limited occupant set point adjustment (warmer-cooler slider bar or switch) and limited operation override capability. Room Temperature Sensors shall be 20,000-ohm thermistor type with a temperature range of -40 to 140 degrees F (-38 to 60 degrees C). The sensor shall be complete with a decorative cover and suitable for mounting over a standard electrical utility box. These devices shall have an accuracy of 0.5 degrees F (.024 degrees C) over the entire range.
- D. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.
- E. Low Air Temperature Sensors: Provide SPST type switch, with 15 to 55 degrees F (-9 to 13 degrees C), range, vapor-charged temperature sensor. Honeywell model L482A, or approved equivalent.
- F. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. All relays shall be plugged in, interchangeable, mounted on a subbase and wired to numbered terminals strips. Relays installed in panels shall all be DPDT with indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.
- G. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120 VAC/24 VAC operation.
- H. Line voltage protection: All DDC system control panels that are powered by 120 VAC circuits shall be provided with surge protection. This protection is in addition to any internal protection provided by the manufacturer. The protection shall meet UL, ULC 1449, IEEE C62.41B. A grounding conductor, (minimum 12 AWG), shall be brought to each control panel.

- I. Alarms: Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an ' Alarms' view. Alarms, and reporting actions shall have the following capabilities:
1. Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
 2. Alarm Categories: The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.
 3. Alarm Templates: Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.
 4. Alarm Areas: Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Alarm Areas in the Graphic Pane.
 5. Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
 6. Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement and total number of Alarms in the BAS Server database.
 7. Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
 8. Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the BAS server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:
 - a. Print: Alarm information shall be printed to the BAS server's PC or a networked printer.
 - b. Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
 - c. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).

- d. Write Property: The write property reporting action updates a property value in a hardware module.
 - e. SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an alarm.
 - f. Run External Program: The Run External Program reporting action launches specified program in response to an event.
- J. Security Access: Systems that Security access from the web browser GUI to BAS server shall require a Login Name and Password. Access to different areas of the BAS system shall be defined in terms of Roles, Privileges and geographic area of responsibility as specified:
- 1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of 'easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
 - a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
 - b. Edit Privileges shall comprise: Setpoint, Tuning and Logic, Manual Override, and Point Assignment Parameters.
 - c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print and Alarm/Event Maintenance.
 - 2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

2.6 GRAPHICAL PROGRAMMING

- A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL is a method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.
- B. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.
- C. Graphic Sequence: The clarity of the graphic sequence shall be such that the operator has the

ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming shall be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 GENERAL

- A. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.
- B. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.
- C. Equipment furnished by the other Contractors that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.
- D. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.4 WIRING

- A. All electrical control wiring to the control panels shall be the responsibility of the Control System Contractor.
- B. All wiring shall be in accordance with the Project Electrical Specifications (Division 16), the National Electrical Code and any applicable local codes. All control wiring shall be installed in raceways.
- C. Excess wire shall not be looped or coiled in the controller cabinet.

- D. Incorporate electrical noise suppression techniques in relay control circuits.
- E. There shall be no drilling on the controller cabinet after the controls are mounted inside.
- F. Careful stripping of wire while inside the cabinet is required to ensure that no wire strand fragments land on circuit boards.
- G. Use manufacturer-specified wire for all network connections.
- H. Use approved optical isolation and lightning protection when penetrating building envelope.
- I. Read installation instructions carefully. Any unavoidable deviations shall be approved by owner's rep prior to installation.

3.5 ACCEPTANCE TESTING

- A. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.
- B. The Control System Contractor shall perform tests to verify proper performance of components, routines and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- C. System Acceptance: Satisfactory completion is when the Control System Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.6 OPERATOR TRAINING

- A. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the Control System Contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
- B. The Control System Contractor shall provide 4 total hours of comprehensive training. for system orientation, product maintenance and troubleshooting, programming and engineering,

3.7 INSTALLATION

- A. All wiring shall be properly supported and run in a neat and workmanlike manner. All wiring exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals. All wiring shall be in accordance with all local and national codes. All line voltage wiring, all wiring exposed, and all wiring in equipment

rooms shall be installed in conduit in accordance to the electrical specifications. All electronic wiring shall be #18 AWG minimum THHN and shielded if required, except standard network (Ethernet, Eschelon, MS/TP etc.) cabling shall be as tested and recommended.

- B. Communication network shall be an overall shielded cable to prevent electrical noise from interfering with data transmission. All network cable splices shall be at controller locations. Splices elsewhere in the communication network are not acceptable.
- C. Enter all computer data into the related computers including all graphics, control programs, initial approved parameters and settings, and English descriptors. Maintain compact disk (CD) or DVD copies of all data file and application software for reload use in the event of a system crash or memory failure including an untranslated copy (2nd copy provided to Institution). One copy shall be delivered to the Department during training sessions, and one copy shall be archived in the contractor's local software vault.
- D. Install equipment as indicated to comply with manufacturer's written instructions.
- E. Verify location of space sensors, thermostats, and other exposed control sensors with plans and room details before installation. Locate concealed type space sensors 60 inches above floor, otherwise, 48 inches above floor from center of highest operable adjustment control in accordance to ADA requirements. Space mounted devices are to be identical in appearance. All devices shall be mounted under the same style cover.
- F. Install labels and nameplates to identify control components according to Division 23 Sections specifying mechanical identification.
- G. Install controls so that adjustments and calibrations can be readily made.
- H. Provide all relays, switches, sources of electricity and all other auxiliaries, accessories and connections necessary to make a complete operable system in accordance with the sequences specified.
- I. Patch all wall, ceiling and floor penetrations resulting in either equipment removal or new work. Patch to match existing materials and finishes.
- J. Install labels and nameplates to identify control components according to GRM Sections specifying mechanical identification.

3.8 WARRANTY PERIOD SERVICES

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.
- B. Within this period, upon notice by the Owner, any defects in the BMS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control System Contractor at no expense to the Owner.

3.9 START-UP

- A. Manufacturer's Field Services: Provide the services of a factory-authorized service

representative to start control systems, load all software, configure network communications, inspect installation of HVAC equipment, obtain and coordinate third party controls, and provide a written report.

- B. Completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequences of operation approved.
- C. Witnessed acceptance demonstration shall display and demonstrate each type of data entry to show site specific customizing capability; demonstrate parameter changes; execute digital and analog commands; and demonstrate DDC loop stability via trend of inputs and outputs, verify component's address and communication loop functions.
- D. Test and adjust controls and safeties. Provide copies of alarm logs to verify alarm operation.
- E. Replace damaged or malfunctioning controls and equipment.
- F. Start, test, and adjust control systems. Provide programming of schedules and operating units after consultant with Institution's Representative and Building's Operating Personnel.
- G. Demonstrate compliance with requirements.
- H. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.
- I. Assist testing, balancing, and adjusting subcontractor.

3.10 COMMISSIONING

- A. Manufacturer's Field Services: Provide the services of a factory-authorized service representative to start control systems.
- B. Perform a commissioning procedure consisting system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets which shall be submitted to the engineer. The commissioning must be coordinated with the Institution to ensure systems are available when needed. Notify the Institution in writing of the testing schedule so that authorized personnel from the Institution are present throughout the commissioning procedure.
- C. System Programming Commissioning:
 - 1. After control devices have been commissioned (i.e. calibrated, tested and signed off), each DDC program shall be put on line and commissioned. The Contractor shall, in the presence of Institution personnel, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy's. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and retested.
- D. Integrated System Commissioning:

1. After all DDC programs have been commissioned, the Contractor shall verify the overall system performance as specified WARRANTY ACCESS
- A. The Owner shall grant to the Control System Contractor reasonable access to the BMS during the warranty period. Remote access to the BMS (for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period) will be allowed.

3.11 OPERATION & MAINTENANCE MANUALS

- A. See Division 1 for requirements. O&M manuals shall include the following elements, as a minimum:
 1. As-built control drawings for all equipment.
 2. As-built Network Communications Diagram.
 3. General description and specifications for all components.
 4. Completed Performance Verification sheets.

3.12 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION OF 230900

SECTION 233113 - METAL DUCTS & FIRE DAMPERS

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. Single-wall rectangular ducts and fittings.
 - 2. Sheet metal materials.
 - 3. Fire Dampers.
 - 4. Hangers and supports.

1.3 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top and bottom of ducts.
 - 5. Dimensions of all duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.
 - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 12. Hangers and supports, including methods for duct and building attachment.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: A single set of plans, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.

2.3 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

2.4 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ruskin.
 2. Pottorff.
 3. Greenheck Fan Co.
- B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory, galvanized sheet steel.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, galvanized sheet steel.
- I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

- D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Install fire dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with specific installation requirements of the damper UL listing.
- J. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.
- K. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.

3.2 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size,"; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 CONNECTIONS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 STARTUP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.6 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
 - 1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

B. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

END OF SECTION 233113

SECTION 233416 - CENTRIFUGAL HVAC FANS

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. Square in-line centrifugal fans.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
 - 2. Rated capacities, operating characteristics, and furnished specialties and accessories.
 - 3. Certified fan performance curves with system operating conditions indicated.
 - 4. Certified fan sound-power ratings.
 - 5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 6. Material thickness and finishes, including color charts.
 - 7. Dampers, including housings, linkages, and operators.
 - 8. Fan speed controllers.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 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. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For centrifugal fans to include in normal operation, emergency operation, and maintenance manuals with replacement parts listing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Startup."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 SQUARE IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. PennBarry.
- B. Description: Square in-line centrifugal fans.
- C. Housing:
 - 1. Housing Material: Reinforced steel.
 - 2. Housing Coating: Hot-dip galvanized.
 - 3. Housing Construction: Side panels shall be easily removable for service. Include inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Fan Wheels: Aluminum airfoil blades welded to aluminum hub.
- F. Motor Enclosure: Open, dripproof.
- G. Accessories:
 - 1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
 - 2. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 3. Companion Flanges: For inlet and outlet duct connections.
 - 4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide OSHA approved guard for inlet or outlet for units not connected to ductwork.

5. Motor and Drive Cover: Epoxy-coated steel.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors.
- B. Furnish with integral speed controller.

2.4 SOURCE QUALITY CONTROL

- A. AMCA Certification for Fan Aerodynamic Performance Ratings: Test, rate, and label in accordance with AMCA 211.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install centrifugal fans level and plumb.
- B. Lift and support units with manufacturer's designated lifting or supporting points.
- C. Equipment Mounting:
 1. Support duct-mounted and other hanging centrifugal fans directly from the building structure, using suitable hanging systems.
- D. Install units with clearances for service and maintenance.

3.2 DUCTWORK AND PIPING CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.
- B. Install ducts adjacent to fans to allow service and maintenance.

3.3 ELECTRICAL CONNECTIONS

- A. Ground equipment and connect wiring according to applicable Division 26 Sections.
- B. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

3.5 STARTUP SERVICE:

- A. Perform startup service.
 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 2. Verify that shipping, blocking, and bracing are removed.
 3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 4. Verify that cleaning and adjusting are complete.
 5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
 6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 9. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Lubricate bearings.

3.7 CLEANING

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Fans and components will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

3.9 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233416

SECTION 238239.19 - WALL AND CEILING UNIT HEATERS

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 wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 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. Include details of anchorages and attachments to structure and to supported equipment.
 - 4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
 - 5. Wiring Diagrams: Power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Berko; Marley Engineered Products.

2. INDEECO.
3. QMark; Marley Engineered Products.

2.2 DESCRIPTION

- A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
- B. 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.

2.3 CABINET

- A. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
- B. Finish: Baked enamel over baked-on primer with manufacturer's standard color, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

- A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection.

2.5 FAN AND MOTOR

- A. Fan: Aluminum propeller directly connected to motor.
- B. Motor: Permanently lubricated. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

- A. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch. Line voltage thermostat in the space.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall and ceiling unit heaters to comply with NFPA 90A.
- B. Install wall and ceiling unit heaters level and plumb.
- C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

END OF SECTION 238239.19

SECTION 260010 - GENERAL REQUIREMENTS ELECTRICAL

PART 1 - GENERAL REQUIREMENTS

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 GENERAL

- A. The conditions of Division 1 apply to each and every Contractor or other person or persons supplying any material or labor entering this building, either directly or indirectly. In the event of a conflict between Division 26, and Division 1, the terms of Division 1 shall govern.
- B. The term “indicated” means all information included, detailed, shown and/or implied on the Contract Documents.
- C. The term “existing” is used generally in reference to renovation projects. On new construction projects, the term “existing” is intended to mean work already in place.

1.3 SCOPE AND OBJECTIVES OF THE ELECTRICAL WORK

- A. The Scope and Objectives of the Electrical Construction Work of this Project include, but are not limited to:
 - Periodic inspection of completed work and site conditions by the Electrical Trade Contractor's Project Manager to confirm compliance with contract documents and verify suitability to receive subsequent work.
 - Provide new electrical distribution equipment and wiring.
 - Provide new convenience power outlets, switches and devices.
 - Provide new generators and auto-transfer switches.
 - Prepare and submit as a shop drawing, minimum 1/4" to the foot scale sketches indicating compliance with code clearance, and equipment manufacturer's recommended clearance for maintenance typical for all electrical equipment, gear panels and electrical rooms. Review clearance with owner's maintenance personnel prior to submitting shop drawing for review and prior to proceeding with physical work.
 - Provide new lighting fixtures
 - Demolition and removals.
 - Site work including concrete work, excavation and backfill for transformer pads.
 - Fire alarm system additions and modifications.

Refer to Division 01 Section “Summary” for additional information.

- B. Division 26, & 28 Specification Sections are the Electrical Trade Contractor's scope of work and responsibility.

1.4 HAZARDOUS MATERIALS

- A. The use of asbestos, PCB's or any material or product containing hazardous materials in the performance of this contract is not permitted. Certify in writing that no hazardous material or product containing a hazardous material, has been furnished or installed.

1.5 LAWS, ORDINANCES, REGULATIONS AND PERMITS

- A. All electrical work required by the Electrical Trade Contractor must comply with the requirements of the National Electrical Code, NFPA, FEMA and other boards and departments having local jurisdiction.

1.6 TESTS

- A. Concealed work must remain uncovered until all required tests have been completed; but if construction schedule requires, arrange for prior tests on parts of systems as approved. If Electrical work is covered prior to completing the required tests, the Contractor or sub-contractor who covered the work is responsible for any additional costs related to completing the required tests.
- B. Prove conclusively, by testing, that Electrical systems operate properly, efficiently and quietly in accordance with intent of drawings, specifications and most widely used construction practice.

1.7 INSTRUCTING PERSONNEL

- A. After all tests and adjustments have been made, fully instruct the representatives of the owner in all details of operation of the equipment installed under the Electrical contract.
- B. Operate Electrical equipment for sufficient length of time to satisfy that requirements of Contract Documents have been fulfilled.
- C. Videotape each training session in VHS format and present two copies of each training session to the institution.

1.8 ENTRANCE OF ELECTRICAL EQUIPMENT

- A. Determine the method of equipment entrance and removal prior to bidding. Do not scale equipment or component sizes off the drawings. Determine sizes from equipment manufacturer. Include cost of equipment manufacturer's knockdown, use of field assembled equipment, field assembly, all work required for access, removals, replacements, general construction, and the like, as required. During shop drawing preparation, verify whether knocked-down or pre-disassembled equipment have been proposed all to the extent required to permit entry of equipment to final location. Verify that the use of field assembled (not pre-assembled) equipment complies with manufacturer's warranty, guarantee, listings and requirements.
- B. Perform all necessary rigging required for completion of the Electrical work.

- C. Deliver products to the site properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification. Deliver products and equipment to the site properly weatherproofed. Maintain weatherproofing until the product or equipment is properly installed.

1.9 SERVICING OF EQUIPMENT AND SYSTEMS

- A. After work has been completed in accordance with the Contract Documents, and prior to final acceptance tests, Electrical Trade Contractor must have manufacturers or their authorized agents of the equipment installed, completely check their equipment and put equipment into proper operation. The manufacturers shall thoroughly check the complete installation of the equipment, furnished by the manufacturer, for proper and correct operation under the service intended.
- B. Six months after final acceptance of the work, have the manufacturers again check their equipment for proper operation and lubrication. Coincidentally, Electrical Trade Contractor must assure that the Institution's appointed Representative is properly instructed in the servicing of the equipment.
- C. Prior to expiration of the guarantee period, Electrical Trade Contractor must check all equipment, materials and systems for which he is responsible, make necessary adjustments and/or replacements, and leave systems in first class operating condition.

1.10 CONTINUITY OF SERVICES

- A. Generally, no actions can be taken by the Electrical Trade Contractor that will interrupt any of the existing building services for these buildings or any other building until previously arranged and scheduled with the Twp
- B. Should any unscheduled service interruption occur, the Electrical Trade Contractor must immediately provide all labor, including overtime if necessary, and all material and equipment necessary for restoration of such service, at no additional cost to the Twp

1.11 TEMPORARY FACILITIES, UTILITIES AND HEATING

- A. Refer to General Conditions and Division 1 of these specifications.

1.12 SMOKE AND FIRESTOPPING (GENERAL)

- A. Furnish and install a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and to maintain the integrity of the "fire and/or smoke" rated construction. Provide firestopping in the following locations:
 - 1. Conduit, Electrical Fixture and Electrical Equipment penetrations through above grade floor slabs and through "fire and/or smoke"-rated partitions and fire walls.
 - 2. Penetrations of vertical shafts including, but not limited to pipe chases, duct chases, elevator shafts, and utility chutes.
 - 3. The gaps at the joint of the above grade floor slabs and curtain walls.
 - 4. Other locations where indicated or required.

- B. Submit shop drawings for approval. Include manufacturer's descriptive data, typical details, installation instructions and the fire/smoke test data and/or report as appropriate for the time rated construction and location. The fire/smoke test data must include a certification by a nationally recognized testing authority that the material has been tested in accordance with ASTM E 814, or UL 1479 fire tests.
- C. Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, and protect from damage and exposure to elements. Damaged, deteriorated or outdated shelf life materials shall not be used and must be removed from the site.

1.13 CONNECTIONS TO EXISTING SYSTEMS

- A. Provide wiring extensions and connections to existing equipment and systems.

1.14 COORDINATION DRAWINGS

- A. The Plumbing Contractor will initiate the Coordination Drawing Process. The Electrical Trade Contractor must participate in the preparation of coordination drawings and facilitate the work/input of Plumbing Trade Contractor and all other Prime Contractors and Sub-Contractors relative to the 100% final submission of the coordination drawings. Prepare coordination drawings in accordance with General Conditions of the Contract to a scale of 1/4"=1'-0" or larger; with additional detailing of major elements, components, and systems of Electrical equipment and materials in relationship with other Prime Contractor's systems, installations, and building components. Use proposed equipment shop drawings, which include certified dimensions, service clearances, etc., to prepare the coordination drawings. If equipment is submitted for review after completion of the coordination drawings and rejected during the shop drawing process, because the equipment fails to meet the project specifications, the Electrical Trade Contractor is responsible to revise the coordination drawings and layout the work using equipment which meets the project specifications. Designate all specified return air plenums, locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
 - 1. Indicate the proposed locations of all Prime Contractor's equipment, and materials, Electrical conduit and system components. Include the following:
 - a. Clearances for installing and maintaining insulation.
 - b. Clearances for servicing and maintaining equipment including tube removal and space for equipment disassembly required for periodic maintenance.
 - c. Equipment connections and support details.
 - d. Exterior wall and foundation penetrations.
 - e. Fire-rated wall and floor penetrations.
 - f. Sizes and location of required concrete pads and bases.
 - g. Valve stem movement.
 - h. Service entrance equipment floor plan.
 - i. Location of structural columns, beams and supports.
 - 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls and ceilings and their relationship to other penetrations and installations.
4. The foregoing information and coordination work must be provided by the applicable Contractor using the coordination drawings as initiated by the Plumbing Trade Contractor.

1.15 EXCAVATION AND BACKFILLING

- A. Electrical Trade Contractor must perform all excavation, backfilling and pumping necessary for completion of work for which he is responsible. All excavation is considered classified.
- B. Remove from premises or deposit as directed by Professional all material excavated and not required or suitable for backfilling.
- C. Carefully remove and store soil until underground work is complete and trenches are backfilled and then re-install.
- D. Allow adequate cover over piping, ducts and conduit in trenches. Trench walls must be perpendicular to the top of piping and ducts and trench bottoms must be instrument graded in the direction of flow as required. Earth must be scooped out under pipe hubs to provide a solid bearing for the pipe, duct or conduit on undisturbed earth. Cinder fill, stones or bricks beneath piping are prohibited.
- E. Electrical Trade Contractor must provide sheathing, shoring and bracing necessary to complete his excavation and backfilling work and must exercise every precaution necessary to prevent accident, injury or death to any human and damage to property of others. Remove all debris, sheathing, shoring and bracing upon completion of work.
- F. It is the responsibility of each Contractor to check with the various Utility Companies and make the necessary arrangements to avoid damage to their property. Each Contractor is responsible for damage during excavation to underground structures including, but not limited to electric, structural, piping or equipment. Such damage must be repaired promptly without cost to the Project. Do not dig until all underground utilities are identified and located.
- G. Backfill after inspection and approval. Backfill must be made with clean earth, free from rocks, frozen particles, debris or other foreign materials. Deposit in uniform layers not over six inches (6") thick with each layer mechanically tamped before the next layer is applied. When approved backfill material is not available from the site, each Contractor, at his own expense, must provide additional select backfill to complete installation. Partial backfill on piping leaving all joints exposed is mandatory for all underground gas and underground domestic water systems. Final backfill only after testing procedures have been approved.
- H. All trenches that pass under wall foundations must be backfilled with lean concrete, full height, directly under wall footing, and at a 1:1 slope away from wall or column footing. Trenches that are parallel with and deeper than wall foundations must be backfilled with lean concrete on a 1:1 slope away from the bottom of the wall or column footing.
- I. Where rock is encountered during installation of underground piping systems, carry trenches to a point six inches (6") below invert of pipe and provide a six inch (6") layer of crushed stone or gravel as a cushion.

- J. All excavation work must include all pumping equipment, materials and labor necessary to keep all excavations free of water. Provide well points as required with disposition of water as directed by Professional.
- K. Each Contractor must provide suitable indemnity for all accidents to humans, animals or equipment caused by his excavating and backfilling work. Provide suitable guards, barricades, red lanterns, flares and take the necessary precaution for an approved and safe installation. All trenches must be backfilled at the end of each working day. Where a trench must be left open, provide coverings of adequate size and strength over entire open area. Patch driveways to match existing.

1.16 LAWS, ORDINANCES, REGULATIONS AND PERMITS

- A. The entire Electrical System in all and/or part must conform to all pertinent laws, ordinances and regulations of all bodies having jurisdiction, notwithstanding anything in these drawings or specifications to the contrary.
- B. Contractor must pay all fees and obtain and pay for all permits and inspections required by any authority having jurisdiction in connection with his work.
- C. Electrical work must comply with the requirements of the National Electrical Code, NFPA and other boards and departments having local jurisdiction. The Contractor must obtain and pay for Certifications of Inspection by an authorized Electrical Inspection Agency and by local, municipal and state approving agencies. Inspections performed by the local inspector do not substitute for the Electrical Trade Contractor obtaining independent Inspection by an authorized independent Electrical Inspection Agency.

1.17 CONNECTIONS TO UTILITIES

- A. Contractor must apply for and obtain services from Utility Companies and municipalities. All charges for which Utility Companies and municipalities must be reimbursed must be paid for by the respective Contractor at no additional cost to the Project.

PART 2 - PRODUCTS

2.1 ELECTRICAL MATERIALS AND EQUIPMENT

- A. All materials and equipment must be new and conform to the grade, quality and standards specified herein.
- B. All equipment offered under these specifications is limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature made available to the public and in effect at the time of opening of bids. Testing agency seals, decals and/or nameplate shall be attached to and visible on all equipment.
- C. Items such as panels, switch boards, transformers, lighting fixtures, vibration isolating devices, and all other equipment and material, where applicable and practicable, must each be of one manufacturer.

- D. Install equipment in strict accordance with manufacturer's instructions for type and capacity of each piece of equipment used. Obtain these instructions, which will be considered part of these specifications. Type, capacity and application of equipment must be suitable and operate satisfactorily for the purpose intended in the Electrical Systems.

2.3 INSERTS, HANGER SUPPORTS, CLAMPS, FASTENINGS

- A. All materials, designs and types of inserts, hanger supports and clamps must meet the requirements of the latest edition of the Manufacturers Standardization Society Document MSS-SP-58, Underwriters Laboratories, Inc., National Electrical Code and Factory Mutual Engineering Division Standards where applicable. Insert, hanger support and clamp types referenced herein are shown in MSS-SP-58.
- B. Electrical Trade Contractor is responsible for and must provide all necessary inserts, hanger supports, fastenings, clamps and attachments necessary for support of his work. Select the types of all inserts, hanger supports, fastenings, clamps and attachments to suit both new and existing building construction conditions specifically for the purposes intended.
- C. For Electrical systems, clamps and attachments to steel beams and bar joists must be made using types 20, 21, 23, 25, 27, 28, 29 or 30 as applicable to suit conditions of construction. Clamps and attachments must be selected on the basis of the required load to be supported. Provide all necessary steel angle iron or channel between bar joists, or steel beams where direct attachment cannot be made. Holes are not permitted to be drilled or burned in structural building steel for hanger rod supports. Welding of hangers or supports to structural steel is prohibited.
- D. Toggle bolts may be used in dry wall and lath and block plaster walls. The use of toggle bolts is restricted to the weight limitations imposed by the toggle bolt manufacturer for the size used.
- E. Screws with wooden or plastic plugs, or lead anchors are not acceptable.
- F. For additional requirements refer to the general conditions paragraph "Suspension from Metal Roof Decks- New and Existing".

2.4 CONDUIT SLEEVES

- A. Electrical Trade Contractor must provide all sleeves required and be fully responsible for the final and permanent locations thereof in accordance with "coordination drawings".
- B. Provide sleeves in the following locations and located on coordination drawings:
 - 1. All conduit passing through any decks, concrete slabs or walls.
- C. Extend through construction and finish flush with each surface except where noted otherwise. Provide for a minimum ½" clearance around conduit.
- D. All sleeves in waterproof walls must be fitted and sealed with positive hydrostatic "Link Seals" as manufactured by Thunderline Corporation. Sleeves must be sized accordingly. Link Seals must be placed around conduit and inserted into void between inner wall of sleeve and piping and/or conduit. Tighten link seals as required for watertight seal.

- E. All sleeves must be Schedule 40 steel pipe finished with smooth edges. Sleeves in waterproof walls must be fabricated with minimum 1/4" thick rectangular steel plate placed around mid-point of sleeve, continuously welded to sleeve and then place the entire/plate assembly into proper position prior to erection of walls. Otherwise, provide sleeves with a minimum of three (3) lugs for anchoring.
- F. Pack voids between sleeves and conduit, where located in fire or smoke rated assemblies, in accordance with UL Fire Resistance Directory.
- G. If sleeves are omitted or located incorrectly, the Electrical Trade Contractor, at his own expense, must cut and patch construction to facilitate sleeve installation to the satisfaction of the Professional.
- H. Provide "Link Seals," and insert into voids between conduits that pass through floors.
- I. Where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut through concrete and masonry using a cutting machine, such as a masonry saw or core drill, to insure a neat hole.

2.5 SMOKE/FIRESTOPPING (MATERIALS)

- A. Firestopping materials and systems must consist of commercially manufactured products complying with the following minimum requirements and be asbestos and PCB free:
 - 1. Flame Spread Index: Twenty-five or less when tested in accordance with ASTM E 84.
 - 2. Smoke Density Index: Fifty or less when tested in accordance with ASTM E 84.
 - 3. Nontoxicity: Nontoxic to human beings at all stages of application and during fire conditions.
 - 4. Systems shall comply with Underwriter's Laboratory Listing Requirements.
 - 5. Fire Resistance:
 - a. Materials and systems used to seal penetrations in time rated assemblies must be capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 time temperature fire conditions for 3 hours.
 - b. Materials and systems used to seal openings between floor slabs and curtain walls must be capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 time temperature fire conditions for 3 hours at a 50 mm wide opening between floor slab edge and vertical wall assembly.
 - c. Materials must not require a rise in temperature to install or activate seal.
 - d. Materials must not contain solvents or require hazardous waste disposal.
 - e. Firestop material must not dissolve in water after curing.
- B. Smoke stopping materials must be approved by the authority having jurisdiction.

2.6 VIBRATION ELIMINATION

- A. Provide vibration isolation support provisions for all transformers when such provisions are not furnished and/or integrally mounted by the equipment manufacturers. Provide equipment equal to Amber/Booth Company or Korfund Company, Inc., installed in accordance with vibration isolation manufacturer's recommendations unless specified otherwise herein.

- B. Provide all electrical equipment mounted on, or suspended from, building structure with approved resilient suspension isolation mountings.
- C. Use flexible metallic conduit for all electrical connections to moving or vibrating equipment, such as motors, generators, transformers, and the like.
- D. Rigid conduit or other extended machine assemblies connected to vibration isolated equipment are not permitted to be tied in directly with the building construction. Connect such elements to the equipment through flexible fittings, and support using isolating equipment as required.
- E. All systems must operate free from objectionable vibration and noise. Take all necessary steps required to achieve this result without additional cost to the Project.

PART 3 - EXECUTION

3.1 METHOD OF PROCEDURE

- A. The drawings accompanying these specifications are diagrammatic and intended to cover the approximate and relative locations of the Electrical Systems. Refer to “coordination drawings” and “surveys and laying out work” in the General Conditions.
- B. Installation, connection and interconnection of all components of these systems must be complete and made in accordance with the manufacturer’s instructions and best trade practices.
- C. Erect all parts of equipment furnished at such time and in such manner as not to delay or interfere with other Prime Contractors and their work.
- D. Plug all conduit and fixtures as required during construction to prevent entering of dirt.
- E. Before material is ordered or fabricated, or any work is performed, verify all calculations, sizing, measurements, including lines, grades, pipes conduit and ductwork elevations at the building and be responsible for the correctness thereof. No extra compensation will be allowed on account of differences between actual dimensions, routing and measurements and those indicated in the Contract Documents. Any discrepancies discovered must be submitted to the Professional for consideration before proceeding with the work.
- F. Lay out work and be responsible for the establishment of heights, grades, and the like, for all interior and exterior piping, drains, fixtures, conduit, ductwork, and the like, included in Contract Documents, in strict accordance with the intent expressed thereby; and all the physical conditions to be met at the building and finished grade, and be responsible for accuracy thereof. The establishment of the location of all work must be performed in consideration of the finished work. In case of conflict, equipment and/or materials must be relocated without cost to the Project, as directed by the Professional, regardless of which equipment was installed first. Refer to Article, “Coordination Drawings”, in General Conditions.
- G. Cooperate with other Prime Contractors for the proper securing and anchoring of all work included within these specifications. Use extraordinary care in the erection and installation of all equipment and materials to avoid marring surfaces of the work of other Prime Contractors, as each Prime Contractor will be held financially responsible for all such injury caused by the lack of precaution and due to negligence on the part of his workmen.

- H. Do not run conduit in any concrete slab three inches (3") or less in thickness. Do not place any conduit in any slab where the outside diameter of the pipe or conduit is more than one-quarter the thickness of the slab. The sweep of conduit elbows emerging through concrete slabs must not create any hazard or obstructions.
- I. All conduit and other Electrical materials and equipment shown to be mounted below ceilings are to be kept as close to ceiling areas as possible unless otherwise noted.
- J. Install and arrange all equipment, such as junction boxes, and the like, that will be concealed in construction, to be fully accessible for adjustment, service and maintenance.

3.2 PROTECTION OF ELECTRICAL WORK

- A. All electrical equipment, materials and accessories having polished or plated surfaces, machined finishes or unpainted surfaces must be given a thick coat of a neutral protection grease and carefully covered with thick cloth or heavy building paper held securely in place to protect the finish against damage during the entire period of construction. Protect equipment by the use of canvas tarps, vinyl sheeting or similar materials held securely in place.
- B. Seal all openings in conduit, fittings, fixtures and all other materials to exclude dirt, sand, and other foreign materials.
- C. Exercise every precaution to exclude dust, dirt and all other foreign materials from switchgear rooms, transformers, and all mechanical equipment rooms during construction.

3.3 SUPPORTS

- A. Except where noted otherwise in the specifications and shown on drawings, the General Construction Contractor must provide all materials, including, but not limited to, equipment supports, supplies and labor necessary as required to adequately support, brace and strengthen new and/or existing equipment and materials installed under/or affected by his work.
- B. The design, materials, fabrication and erection of structural steel supports must conform to "Specification for Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction, "Code of Standard Practice for Steel Buildings and Bridges". Welding, where required, must conform to "Code of Arc and Gas Welding in Building Construction" of the American Welding Society.

3.4 ESCUTCHEONS

- A. Provide heavy solid pattern, steel, cast iron or malleable iron escutcheons with set screws and prime coat of paint on all conduit exposed to view within structure where passing through floors, partitions, walls or ceilings. Escutcheons are not required in equipment rooms, boiler rooms or other unfinished areas.
- B. For conduit with sleeves extending above floor, provide escutcheons with deep recesses.
- C. Provide nickel plated cast iron escutcheons where conduit pass through toilet rooms, walls or ceilings.

3.5 HVAC AND PLUMBING CONTRACTOR - ELECTRICAL TRADE CONTRACTOR COORDINATION

- A. All HVAC and Plumbing equipment furnished with electrical equipment shall have current characteristics as shown on electrical drawings and specifications. Prime Electrical Trade Contractor shall review and co-ordinate all shop drawings provided by the HVAC and Plumbing with respect to electrical characteristics and electrical contract requirements.
- B. The Electrical Trade Contractor must provide all push-buttons, safety switches for motors, and wiring from starters to motors and install all starters furnished to him by the HVAC and Plumbing Contractors unless otherwise indicated in the Specifications.
- C. The Electrical Trade Contractor must provide disconnect switches for all equipment under all contracts, except where such switches are an integral part of equipment.

3.6 ELECTRICAL MOTORS AND STARTERS

- A. All motors and starters shall be furnished by HVAC and Plumbing Contractors, unless specified to the contrary in Electrical and/or Electrical Specifications.
- B. Electrical Trade Contractor shall coordinate shop drawings submitted for motor and starter.

3.7 CONDUIT UNDER FLOORS

- A. Wherever conduit or wiring enclosures are run under a floor slab on grade, the work is to be installed after the General Construction Trade Contractor has brought the sub-grade to the proper level.
- B. Electrical Trade Contractor must excavate and backfill for the installation of all of his respective work. The excavation of the sub-grade where required for the installation of the work must be performed, including that for piping, ducts and piping enclosures. When the installation is completed and satisfactorily tested, the remaining space shall be filled with crushed stone or other material similar to that to be used by the General Construction Trade Contractor for the sub-base. The backfill must be stabilized by hand or pneumatic tamping and must be returned to the original sub-grade level.
- C. No conduit or wiring enclosures are to be installed in the stone sub-base which is part of the General Construction Trade Contractor's work unless specific permission is granted by the Owner.
- D. Where conduit is noted to be installed in enclosures, such as concrete, necessary protection of the conduit, arrangement and installation will be as hereinafter described.
- E. Where required by drawing notes, specifications, or Electrical Code, conduits installed under floors must be encased in concrete.

3.8 ELECTRICAL EQUIPMENT IDENTIFICATION

- A. Markers must comply with OSHA Standards.

- B. Identify all Electrical equipment as to nature, service and purpose by means of permanently attached plastic nameplates having ½" high letters, dull black outside and white core. Nameplates of approved size, beveled edges and engraved through black to white core. Nameplates shall indicate equipment identification names and numbers as approved by the Institution.
- C. Identify by Stenciling similar information in letters of approved size and wording on all concealed equipment.

3.9 SMOKE AND FIRESTOPPING (METHODS)

- A. Installation of materials must be performed by applicator/installers qualified, trained and approved by the manufacturer of the materials, and be installed in accordance with ASTM E 814.
- B. Electrical Trade Contractor must install smoke and firestopping at locations required, shown, or specified in accordance with applicable codes, manufacturer's written instructions, and test report. Cutting and patching of construction and providing sleeves, where required, is shown on drawings or specified in other sections.
 - 1. Filling of Voids: Smoke and firestopping materials must completely fill void spaces regardless of geometric configuration, subject to tolerances established by the manufacturer. Smoke and firestopping for filling voids in floors in which the smallest dimension of the void is 4 in. or more must support the same load as the floor is designed to support or must be protected by a permanent barrier to prevent loading or traffic in the smoke or firestopped areas.
 - 2. Electrical Cables or Conduits: Smoke and firestopping at penetrations of electrical cables or conduits must comply with the requirements of NFPA No. 70.
 - 3. Where smoke and firestopping of penetrations in floors, walls and partitions that will be exposed in completed construction, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and provide escutcheons or other trim.
 - 4. Schedule the installation and required inspection of smoke and firestops for penetrations that will be concealed in completed construction prior to erection of floors, walls, and partitions that would permanently conceal the penetrations.
- C. All areas of smoke and firestopping must be accessible until inspection by the local authority having jurisdiction.

3.10 FIRE/SMOKE DAMPERS, SMOKE DETECTORS/SMOKE DETECTOR CONTROL

- A. All fire/smoke dampers for the project must be provided by the HVAC Trade Contractor.
- B. Electrical Trade Contractor shall provide smoke detectors for operation of smoke dampers as applicable and specified. Electrical Trade Contractor shall connect, then test and check out smoke detectors connected to the building's fire alarm system as specified. HVAC Trade Contractor to check out smoke detectors tied into the Building Automation System.
- C. All new duct mounted smoke detectors shall be furnished by the Electrical Trade Contractor and installed by the HVAC Trade Contractor, and shall be installed generally as located on the mechanical drawings.

- D. Refer to Divisions 16 relative to accessories required for electrical work.
- E. Connections for automatic shut down of air handling units shall be provided by the HVAC Trade Contractor, in compliance with the ATC Section of these specifications. Connections for fire alarm system shall be provided by the Electrical Trade Contractor.
- F. HVAC Trade Contractor shall clearly indicate location of all new smoke detectors required in ductwork on sheet metal shop drawing submissions.
- G. Area actuation signals and connections for smoke dampers shall be provided by the Electrical Trade Contractor. Locate signal where visible to Building Personnel.

3.11 CONCRETE AND MASONRY WORK FOR ELECTRICAL WORK

- A. Electrical Trade Contractor must provide all cast-in-place concrete, pre-cast concrete and masonry work (brick and block) required for completion of their contracts, including interior slabs.
- B. Professional will review and approve materials used.
- C. Unless shown or specified otherwise, all equipment foundations and housekeeping pads must be six inches (6") minimum height from floor, of sufficient mass, and secured to the floor.
- D. Unless noted otherwise, concrete bases must be 4" larger than the largest dimension of the base of the supported equipment in both directions. Use 3000 psi, 28-day compressive strength concrete and reinforcement.

3.12 CUTTING AND PATCHING FOR ELECTRICAL WORK

- A. General Contractor will perform all roof cutting and patching.
- B. Electrical Contractor is responsible for his own cutting and patching, which is not associated with the roof work shown on the General Construction Documents.

END OF SECTION 260010

SECTION 260015 - ELECTRICAL SUMMARY OF WORK

PART 1 - GENERAL

1.1 STIPULATIONS

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

1.2 RELATED DOCUMENTS

- A. The specification sections "General Conditions", "Special Requirements", and "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.

1.3 SCOPE OF WORK

- A. The work under this Division of the specification shall include all labor, materials, appliances and services necessary for and incidental to the primary completion of the electrical system for this structure and related work as shown, implied or required by the drawings and/or described hereinafter.
- B. The precise nature of the work is specified in detail in other Sections. As a guide to the general concept of the electrical design, the work herein described shall include, but not be limited to the following:
 - 1. General power circuits.
 - 2. Circuit breakers & distribution equipment.
 - 3. Wiring and conduit systems, boxes and devices.
 - 4. Grounding.
 - 5. Disconnect and removals.
 - 6. Relocations.
 - 7. Connections to new and existing equipment.
 - 8. Emergency generators.
 - 9. Automatic transfer switches.
 - 10. Dry type transformers.
 - 11. Short circuit coordination study.

1.4 CURRENT CHARACTERISTICS AND LOAD RATINGS OF MOTORS AND EQUIPMENT

- A. The intended electrical characteristics of all motors and equipment are noted only on the Electrical Drawings.
- B. Furnish to all other contractors, data relating to the electrical characteristics of their equipment as shown on the Electrical Drawings, that they may furnish correct equipment. Assume all responsibility for correction of problems arising from failure to do so.

1.5 UTILITY CONNECTIONS

- A. The information given regarding methods and materials for connection to the utility lines, existing electric equipment, or any other systems represents the best information available to the Professional at time of design. This Contractor shall visit the site and determine all requirements for such connection, and any costs or fees involved, and shall include the costs thereof in his bid.

1.6 CODE COMPLIANCE

- A. The contractor shall comply with the requirements of the latest National Electrical Code, all state & local codes and all other authorities having jurisdiction, regardless of what is indicated on the drawings or specified herein.

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 EQUIPMENT WIRING AND CIRCUIT REQUIREMENTS, TRADE EQUIPMENT

- A. Connect all equipment circuited on the drawings. The equipment required to be connected includes equipment furnished by the Building Trades.
- B. Wiring circuiting (phase, voltage, wire size, connection device, and ampacity) shown on the drawings is the best available information, at the time of design document preparation. Base all cost proposals for the electrical work of this project upon the contract drawings.
- C. Prior to providing any roughing-in material and labor, and prior to ordering panels and devices, proceed as follows:
 - 1. For electrically operated equipment, furnished by other trades:
 - a. Thoroughly review all shop drawings and/or other sources including responsible building trades for electrical data.
 - b. Plan, schedule, coordinate and document, on as-built records, all and every detail required to serve all such equipment.
 - c. Take full responsibility for matching the precise requirements, prior to installation.
 - d. Provide promptly, free of charge, any change required in completed circuiting and device installation, on account of incomplete, or inaccurate Contractor coordination.
 - e. Requests for change orders in material, which result from differences between the contract documents and the final on-site electrical circuiting requirements must be submitted for approval, prior to ordering changed equipment. Requests for such change orders must be accompanied by material cost and labor cost, comparing specified items to changed items.

3.2 DISCONNECT AND REMOVALS

- A. Use disconnect and removal information, shown on plans and in specifications exclusively as a guide. Coordinate and plan all disconnect and removal work with the work directed to be relocation and refer to the electrical specification section "Relocations" for further details.
- B. Visit the site prior to submitting a bid, and include in the bid price all labor and material necessary to remove, relocate, and/or modify the items which interfere with the new construction. Include wiring extensions, removals and relocations.
- C. Provide all incidental items including, but not limited to cover plates, boxes, and appurtenances.
- D. Patch all new access holes and vacated original holes thru floors and walls as required to maintain integrity of fire rating in complete compliance with this GRE.
- E. Re-energize, provide necessary wiring extensions to any and all existing items whose use is to continue, and provide all testing and check out to restore proper operation. Investigate test verify and confirm all wiring in the area of construction, whose use is continuing, and take prudent steps to protect such systems and equipment, during the work of all contractors on the job.

3.3 RELOCATIONS

- A. Visit the site, survey any and all field conditions, systems and equipment related to equipment being relocated, and include all labor and material necessary to carry-out the relocation directions and include provisions to handle all site conditions.
- B. Disconnect, remove, clean, test and checkout, and then re-install all such equipment as shown or as directed. Protect all equipment after disconnections, and removal, prior to reinstallation. Remove, re-route and reinstall test checkout, and reconnect all branch wiring associated with relocated equipment, unless new circuits and connections to new systems are specifically designed, planned and specified.

3.4 POWER OUTAGES

- A. All work associated with power outages shall be coordinated with the Authority.
- B. During power outages, provide temporary back-up generator of sufficient capacity and voltage to maintain building operation. Include in bid the cost to maintain services to the entire building via back-up generator.

3.5 SHORT CIRCUIT COORDINATION STUDY

- A. Provide Short Circuit Coordination Study in accordance with IEEE 242.399 and 551 for setting of main service circuit breakers and all adjustable circuit breakers.

END OF SECTION 260015

SECTION 260513 - WIRES AND CABLES

PART 1 - GENERAL

1.1 STIPULATIONS

- 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 building wires and cables and associated splices, connectors, and terminations for wiring systems rated 600 volts and less.
- B. Related Sections: The following paragraphs in Section 16 contain requirements that relate to this Section:
 - 1. "Supporting Devices" for supports and anchors for fastening cable directly to building finishes.
 - 2. "Electrical Identification" for insulation color coding and wire and cable markers.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and General Requirements.
- B. Field test reports indicating and interpreting test results relative to compliance with performance requirements of testing standard.

1.4 QUALITY CONTROL

- A. Testing Firm Qualifications: In addition to the requirements specified in Division 1 Section "Quality Control Services," an independent testing firm shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be a full member company of the International Electrical Testing Association (NETA).
 - 1. Testing Firm's Field Supervisor Qualifications: A person currently certified by the NETA National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Comply with NFPA 70 "National Electrical Code" for components and installation.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 SEQUENCING AND SCHEDULING

- A. Coordination: Coordinate layout and installation of cable with other installations.
 - 1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable according to NEMA WC-26.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wires and Cables:
 - a. American Insulated Wire Corporation, Leviton Manufacturing Co.
 - b. Brand-Rex Cable Systems, Brintec Corp.
 - c. Carol Cable Company, Inc.
 - 2. Connectors for Wires and Cables:
 - a. AFC, Monogram Co.
 - b. AMP, Inc.
 - c. Anderson, Square D Co.

2.2 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Applications" Article.
- B. Thermoplastic Insulation: Conform to NEMA WC 5.
- C. Cross-Linked Polyethylene Insulation: Conform to NEMA WC 7.
- D. Solid conductor for 10 AWG and smaller; stranded conductor for larger than 10 AWG. Minimum size shall be 12 AWG , copper conductor.
- E. Color coding shall conform to the following:

<u>PHASE</u>	<u>120/208 VOLT</u>	<u>277/480 VOLT</u>
A	Black	Yellow

B	Red	Brown
C	Blue	Orange
Neutral	White	White
Ground	Green	Green

1. The colors shall be factory-applied to entire length of the conductors by one of the following methods as noted and listed below:
 - a. Solid color compound.
 - b. Solid color coating.
 - c. Colored bands or hash marks with maximum spacing of 18".
 - d. Colored fibrous covering.
2. All branch circuit conductors Nos. 12 and 10 shall be solid color compound, solid color coating or colored fibrous covering. All sizes of conductors used for neutrals and equipment grounds shall be solid compound or solid color coating white and green, respectively. All phase conductors No. 8 and larger with stripes, bands or has marks shall have a background color other than white or green.
3. The solid color coating, stripes, bands or hash marks shall be a strongly adherent paint or dye not injurious to the insulation which will not be obliterated by pulling into a conduit or raceway. The stripes, bands or hash marks shall be sufficiently wide and clear to be readily distinguishable after installation.

2.3 CONNECTORS AND SPLICES

- A. UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated. Select to comply with Project's installation requirements and as specified in Part 3 "Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Feeders: Type THHN/THWN, copper conductor, in raceway and Type RHW, 2-hour fire rated, copper conductor in raceway (Ray Chem or Equal).
- B. Branch Circuits: Type THHN/THWN, copper conductor, in raceway.
- C. Fire Alarm Circuits: Type THHN/THWN, copper conductor, in raceway.
- D. Class 1 Control Circuits: Type THHN/THWN, copper conductor, in raceway or plenum rated cable where permitted by NEC.

- E. Class 2 Control Circuits: Type THHN/THWN, copper conductor, in raceway or plenum rated cable where permitted by NEC.
- F. Metal clad cable with internal ground wire may be used where permitted by N.E.C. for branch circuits run concealed, provided that the outer metal armor of cable is identified as an acceptable ground return path.
- G. Data processing cables under raised floor shall comply with Article 645 of the N.E.C.

3.3 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and the NECA "Standard of Installation."
- B. Pull conductors into raceway simultaneously where more than one is being installed in same raceway.
 - 1. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
 - 2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- C. Install exposed cable, parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible. Review all exposed conduit with professional.
- D. Conductor Splices: Keep to minimum.
 - 1. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
 - 2. Use splice and tap connectors that are compatible with conductor material.
- E. Wiring at Outlets: Install with at least 12 inches of slack conductor at each outlet.
- F. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.4 FIELD QUALITY CONTROL

- A. Testing Firm: Provide the services of a qualified independent testing firm to perform specified field quality-control testing.
- B. Testing: Upon installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA Standard ATS, Section 7.3.1. Certify compliance with test parameters.

- C. Correct malfunctioning products at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

3.5 SHORT CIRCUIT COORDINATION STUDY

- A. Provide short circuit coordination study in accordance with IEEE 242.399 and 551 for setting of the main service circuit breakers and all adjustable circuit breakers.

END OF SECTION 260513

SECTION 260515 - MEDIUM-VOLTAGE CABLES

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 cables and related splices, terminations, and accessories for 15KV electrical distribution systems.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and General Requirements.
- B. Product data for cables and cable accessories, including splices and terminations.

1.4 QUALITY CONTROL

- A. Installer Qualifications: Engage an experienced and certified cable splicer to install, splice, and terminate medium-voltage cable.
- B. Comply with NFPA 70 "National Electrical Code" for components and installation.
- C. Comply with IEEE C2 "National Electrical Safety Code" for components and installation.
- D. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver medium-voltage cable on factory reels conforming to NEMA WC 26.
- B. Store cables on reels on elevated platforms in a dry location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Cables:
 - a. Hubbell Inc., The Kerite Co.
 - b. The Okonite Co.
 - c. Power Cable Division, Pirelli Cable Corp.
 - d. Rome Cable Corp.
 - 2. Cable Splicing and Terminating Products and Accessories:
 - a. Cooper Power Systems, Inc., RTE Components.
 - b. Elastimold.
 - c. G&W Electric Co.
 - d. Energy Division, Raychem Corp.
 - e. Thomas and Betts.

2.2 CABLES

- A. Cable Type: Type MV 90.
- B. Conductor: Copper.
- C. Conductor Stranding: Class B.
- D. Insulation: Ethylene-propylene conforming to NEMA WC 7 (ICEA S-68-516).
 - 1. Voltage Rating: 5 kV.
 - 2. Insulation Thickness: 133 percent insulation level.
- E. Shielding: Copper tape, helically applied over semiconducting insulation shield.

2.3 SPLICE KITS

- A. Connectors: IEEE 404, compression type, as recommended by cable or splicing kit manufacturer for the application.
- B. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, materials, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.

2.4 SOLID TERMINATIONS

- A. Conductor Terminations: Comply with IEEE Standard 48, as indicated. Insulation class equivalent to that of the cable. Terminations for shielded cables include a shield grounding strap.
 - 1. Class 3 Termination for Shielded Cable: Kit with stress cone and compression-type connector.

2.5 SEPARABLE INSULATED CONNECTORS

- A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
- B. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.
- C. Load-Break Cable Terminators: Elbow-type units with 200-A load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

2.6 SOURCE QUALITY CONTROL

- A. Test and inspect cables according to NEMA WC 7 before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine raceways to receive medium-voltage cables for compliance with installation tolerances and other conditions affecting performance of the cable. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install medium-voltage cable as indicated, according to manufacturer's written instructions and IEEE 576.
- B. Pull conductors simultaneously where more than one cable is indicated in same raceway. Use NRTL-listed and manufacturer-approved pulling compound or lubricant where necessary. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means including, fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceways. Do not use rope hitches for pulling attachment to cable.

- D. Install splices at pull points and elsewhere as indicated using standard kit. Conform to kit manufacturer's written instructions.
- E. Install terminations at ends of conductors and seal multiconductor cable ends with standard kits. Conform to manufacturer's written instructions. Comply with classes of terminations indicated.
- F. Install separable insulated-connector components as follows:
 - 1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
 - 2. Portable Feed-Through Accessory: Three.
 - 3. Standoff Insulator: Three.

3.3 GROUNDING

- A. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated connector fittings, and hardware according to manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports.
- B. Perform the following tests and inspections and prepare test reports:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 - 2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
- C. Remove and replace malfunctioning units and retest as specified above.

3.5 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to Manufacturer and Installer, to prevent entrance of moisture into the cable and ensure that medium-voltage cable is without damage or deterioration at Substantial Completion.

END OF SECTION 260515

SECTION 260526 - GROUNDING

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 grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 26 Section "Wires and Cables" for requirements for grounding conductors.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and General Requirements.
- B. Product Data for grounding rods, connectors and connection materials, and grounding fittings.
- 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 Professionals and Departments, and other information specified.
- D. Field tests and observation reports certified by the testing organization and indicating and interpreting the test reports for compliance with performance requirements.

1.4 QUALITY CONTROL

- A. Comply with NFPA 70.
- B. Comply with UL 467.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Apache Grounding; Nashville Wire Products.
 2. Boggs: H. L. Boggs & Co.
 3. Chance: A. B. Chance Co.

2.2 GROUNDING AND BONDING PRODUCTS

- A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3 WIRE AND CABLE GROUNDING CONDUCTORS

- A. Comply with Division 26 Section "Wires and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
- B. Equipment Grounding Conductors: Insulated with green color insulation.
- C. Grounding-Electrode Conductors: Stranded cable.
- D. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
- E. Bare Copper Conductors: Conform to the following:
 1. Solid Conductors: ASTM B 3.
 2. Assembly of Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.

2.4 MISCELLANEOUS CONDUCTORS

- A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.
- B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.
- C. Bonding Straps: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.5 CONNECTOR PRODUCTS

- A. Pressure Connectors: High-conductivity-plated units.
- B. Bolted Clamps: Heavy-duty type.
- C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2.6 GROUNDING ELECTRODES

- A. Grounding Rods: Copper-clad steel.
- B. Grounding Rods: Sectional type; copper-clad steel.
 - 1. Size: 3/4 inch by 120 inches.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
 - 1. Install equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:
 - a. Feeders and branch circuits.
 - b. Lighting circuits.
 - c. Receptacle circuits.
 - d. Single-phase motor or appliance branch circuits.
 - e. Three-phase motor or appliance branch circuits.
 - f. Flexible raceway runs.
 - g. Armored and metal-clad cable runs.
 - 2. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
 - 3. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and above, including air cleaners and heaters. Bond conductor to each unit and to air duct.
 - 4. Water Heater, Heat-Tracing, and Antifrost Heater Circuits: Install a separate equipment grounding conductor to each electric water heater, heat-tracing assembly, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- B. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide a No. 4 AWG minimum insulated grounding conductor in

raceway from grounding-electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

- C. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-26.

3.2 INSTALLATION

- A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- B. Grounding Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.
 - 1. Drive until tops are 2 inches below finished floor or final grade, except as otherwise indicated.
 - 2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.
- C. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- D. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 inches below grade.
- E. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.
- F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors. Ground gas piping as required per NEC.

3.3 CONNECTIONS

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.4 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Engage an independent electrical testing organization to perform tests described below.
- B. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.
- C. Maximum grounding to resistance values are as follows:
1. Equipment Rated 500 kVA and Less: 10 ohms.
 2. Unfenced Substations and Pad-Mounted Equipment: 5 ohms.

3. Manhole Grounds: 10 ohms.
- D. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Department promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

END OF SECTION 260526

SECTION 260533 - RACEWAYS, BOXES AND CABINETS

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.
- B. Raceways include the following:
 - 1. Rigid metal conduit.
 - 2. Intermediate metal conduit.
 - 3. Electrical metallic tubing (EMT).
 - 4. Flexible metal conduit.
 - 5. Liquidtight flexible conduit.
 - 6. Wireway.
 - 7. Surface raceways.
- C. Boxes, enclosures, and cabinets include the following:
 - 1. Device boxes.
 - 2. Floor boxes.
 - 3. Outlet boxes.
 - 4. Pull and junction boxes.
 - 5. Cabinets and hinged cover enclosures.
- D. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 26 Section "Wiring Devices" for devices installed in boxes and floor box service fittings.

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and General Requirements.
- B. Product data for surface raceway, wireway and fittings, floor boxes, hinged cover enclosures, and cabinets.

- A. Comply with NFPA 70 "National Electrical Code" for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- C. Comply with NECA "Standard of Installation."
- D. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering Products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Metal Conduit and Tubing:
 - a. Monogram Co., AFC.
 - b. Alflec Corp.
 - c. Allied Tube and Conduit, Grinnell Co.
 - 2. Conduit Bodies and Fittings:
 - a. Scott Fetzer Company, Adalet-PLM.
 - b. American Electric, Construction Materials Group.
 - c. Emerson Electric Co., Appleton Electric Co.
 - 3. Wireway:
 - a. Hoffman Engineering Co.
 - b. Keystone/Rees, Inc.
 - c. Square D Co.
 - 4. Surface Metal Raceway:
 - a. Airey-Thompson Co., Inc., A-T Power Systems.
 - b. American Electric, Construction Materials Group.
 - c. The Wiremold Co., Electrical Sales Division.
 - 5. Boxes, Enclosures, and Cabinets:

- a. Scott Fetzer Company, Adalet-PLM.
- b. Butler Manufacturing Co., Walker Division.
- c. Cooper Industries, Midwest Electric.

2.2 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Rigid Aluminum Conduit: ANSI C80.5.
- C. Intermediate Metal Conduit: ANSI C80.6.
- D. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
- E. Electrical Metallic Tubing and Fittings: ANSI C80.3 with compression-type fittings.
- F. Flexible Metal Conduit: Aluminum.
- G. Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.
- H. Fittings: NEMA FB 1, compatible with conduit/tubing materials.
- I. Minimum size conduit shall be 3/4 inch.

2.3 WIREWAYS

- A. Material: Sheet metal sized and shaped as 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 wireway as required for complete system.
- C. Select features where not otherwise indicated, as required to complete wiring system and to comply with NEC.
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAY

- A. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceway.
- B. Surface Metal Raceway: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating suitable for painting.

2.5 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1.
- B. Cast Metal Boxes: NEMA FB 1, type FD, cast ferrous alloy box with gasketed cover.
- C. Nonmetallic Boxes: NEMA OS 2.

2.6 FLOOR BOXES

- A. Floor Box: Cast metal, fully adjustable, rectangular.

2.7 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1.
- B. Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.8 CABINETS AND ENCLOSURES

- A. Hinged Cover Enclosures: NEMA 250, steel enclosure with continuous hinge cover and flush latch. Finish inside and out with manufacturer's standard enamel.
- B. Cabinets: NEMA 250, type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

- A. Outdoors: Use the following wiring methods:
 - 1. Exposed: Rigid or intermediate metal conduit.
 - 2. Concealed: Rigid or intermediate metal conduit.
 - 3. Underground, Single Run: Rigid nonmetallic conduit. Schedule 40.
 - 4. Underground, Grouped: Rigid nonmetallic conduit. Schedule 40.
 - 5. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.
 - 6. Boxes and Enclosures: NEMA Type 3R or Type 4.

- B. Indoors: Use the following wiring methods:
1. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Flexible metal conduit, except in wet or damp locations use liquidtight flexible metal conduit.
 2. Damp or Wet Locations: Rigid steel conduit.
 3. Exposed: Electrical metallic tubing or rigid metallic conduit.
 4. Concealed: Electrical metallic tubing.
 5. Boxes and Enclosures: NEMA Type 1, except in damp or wet locations use NEMA Type 4, stainless steel.
 6. For voltage over 1000v , use IMC and paint conduit red

3.3 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.
- C. 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.
- D. Install raceways level and square and at proper elevations. Provide adequate headroom.
- E. Complete raceway installation before starting conductor installation.
- G. Use temporary closures to prevent foreign matter from entering raceway.
- H. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- I. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
- J. Use raceway fittings compatible with raceway and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, except as otherwise indicated.
- K. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated.
- L. Raceways Embedded in Slabs: Install in middle third of the slab thickness where practical, and leave at least 1 inch concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 2. Space raceways laterally to prevent voids in the concrete.
 3. Run conduit larger than 1-inch trade size (size 27) parallel to or at right angles to main reinforcement. When at right angles to reinforcement, place conduit close to slab support.
 4. Transition nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
- M. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
1. Run parallel or banked raceways together, on common supports where practical.
 2. Make bends in parallel or banked runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.
- N. Join raceways with fittings designed and approved for the purpose and make joints tight.
1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 2. Use insulating bushings to protect conductors.
- O. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.
- P. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- Q. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.
- R. Install raceway sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-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 and elsewhere as indicated:
1. Where conduits enter or leave hazardous locations.
 2. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
 3. Where otherwise required by the NEC.
- S. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections

are not made under this Contract, install screwdriver-operated threaded flush plugs flush with floor.

- T. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. & connections to motors. Install separate ground conductor across flexible connections.
- U. Do not install aluminum conduit embedded in or in contact with concrete.
- V. Surface Metal Raceway: Install a separate green ground conductor in raceway from the junction box supplying the raceway to receptacle or fixture ground terminals.
- W. Set floor boxes level and adjust to floor surface.
- X. Install hinged cover enclosures and cabinets plumb. Support at each corner.
- Y. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at 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 touch-up coating recommended by the manufacturer.

3.5 CLEANING

- A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 260533

SECTION 261216 - DRY-TYPE, MEDIUM-VOLTAGE TRANSFORMERS

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 dry-type, medium-voltage transformers.

1.3 DEFINITIONS

- A. BAS: Building Automation System.
- B. BIL: Basic Impulse Insulation Level.
- C. VPE: Vacuum Pressure Encapsulation.
- D. VPI: Vacuum Pressure Impregnation.

1.4 PRODUCT REQUIREMENTS

- A. Transformer enclosure shall be tamper proof using tamper proof hardware and ventilating openings in equipment shall be designed such that foreign objects inserted through openings are deflected from energized parts and complies with NEC 110.31 (D).

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For dry-type, medium-voltage transformers.
 - 1. Include plans and elevations showing major components and features.
 - a. Include a plan view and cross section of equipment base, showing clearances, manufacturer's recommended workspace, and locations of penetrations for grounding and conduits.

2. Include details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include single-line diagram.
4. Include list of materials.
5. Include nameplate legends.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawing:

1. Location plan, showing heavy equipment or truck access paths for maintenance and replacement.
2. Dimensioned concrete base, outline of transformer, conduit entries, and grounding equipment locations.

B. Qualification Data: For testing agency.

C. Seismic Qualification Certificates: For transformer assembly, 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: Identify center of gravity, 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.

D. Product Certificates: For transformers, signed by product manufacturer.

E. Source quality-control reports.

F. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformer and accessories to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Eaton
- B. Square D
- C. Siemens

2.2 SYSTEM DESCRIPTION

- 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. Comply with IEEE C2.
- C. Comply with IEEE C57.12.01.

2.3 PERFORMANCE REQUIREMENTS

- A. Windings Material: Copper.
- B. Cooling Systems: Comply with IEEE C57.12.01 for cooling class.
 - 1. Self-Cooled Rating.
 - a. Self-Cooled: 500 kVA.
- C. Coils Insulation Systems:
 - 1. Primary and secondary coil assemblies shall be manufactured using polyester VPI system.
- D. Winding Connections: Connection of windings and terminal markings shall comply with IEEE C57.12.70.
- E. Efficiency: Comply with 10 CFR 431, Subpart K.
- F. Bushings shall comply with IEEE C57.19.01 requirements for impulse and low-frequency insulation levels.
- G. Tap Changer: External, for de-energized operation.
- H. Enclosure:
 - 1. Provide with provisions for lifting and anchoring frame to concrete pad.
 - 2. With an integral skid-mounting frame, suitable to allow skidding or rolling of transformer in any direction.

3. Outdoor Transformer Enclosure Finish: Factory-applied finish in manufacturer's standard
4. Taps: Two 2-1/2-percent, full-capacity taps above and two 2-1/2-percent, full-capacity taps below rated voltage. Comply with IEEE C57.12.36 requirements.

I. Sound level shall comply with requirements of NEMA TR 1.

J. Capacities and Characteristics:

1. Enclosure: Ventilated power transformer, NEMA 3R enclosure.
2. Additional IEEE Standards: Comply with IEEE C57.12.50.
3. Comply with UL 1562 listing requirements.
4. Service Conditions: The transformers shall be suitable for operation under service conditions specified as usual service conditions in IEEE C57.12.01, except for the following:
 - a. Altitudes above 3,300 feet (1,000 m).
 - b. Cooling air or water temperature exceeds limits.
 - c. Excessive load current harmonic factor.
 - d. Operation above rated voltage or below rated frequency.
 - e. Exposure to explosive environments.
 - f. Exposure to fumes, vapors, or dust.
 - g. Exposure to hot and humid climate or to excessive moisture, including steam, salt spray, and dripping water.
 - h. Exposure to seismic shock or to abnormal vibration, shock, or tilting.
 - i. Exposure to excessively high or low temperatures.
 - j. Unusual transportation or storage conditions.
 - k. Unusual grounding resistance conditions.
 - l. Unusual space limitations.
5. Transformer Ratings.
 - a. Impedance: Not less than 3.5 percent.
 - b. Temperature Rise: 150 deg C.
 - c. Coils Connection:
 - 1) High-Voltage Winding: Delta.
 - 2) Low-Voltage Winding: Wye.
 - d. Voltage and BIL Ratings:
 - 1) Nominal primary phase-to-phase voltage and BIL: 4160 V, 30 kV.
 - 2) Nominal secondary voltage and BIL: 480Y/277 V, 10 kV.
6. Taps: Two 2-1/2-percent, full-capacity taps above and two 2-1/2-percent, full-capacity taps below rated voltage. Comply with IEEE C57.12.51 requirements.

2.4 WARNING LABELS AND SIGNS

- A. Comply with requirements for labels and signs specified in Section 260010.

1. Warning signs shall be made of baked enamel.

2.5 SOURCE QUALITY CONTROL

- A. Provide manufacturer's certificate that the transformer design tests comply with IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine dry-type, medium-voltage transformers upon delivery.
 1. Upon delivery of transformers and prior to unloading, inspect equipment for any damage that may have occurred during shipment or storage.
 2. Verify that tie rods and chains are undamaged and tight, and that all blocking and bracing is tight. Verify that there is no evidence of load shifting in transit, and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.
 3. Verify that there is no indication of external damage and no dents or scratches in doors and sill, tank walls, radiators and fins, or termination provisions.
 4. Compare transformers and accessories received with bill of materials to verify that shipment is complete. Verify that transformers and accessories conform with manufacturer's quotation and shop drawings. If shipment is incomplete or does not comply with Project requirements, notify manufacturer in writing immediately.
 5. Unload transformers carefully, observing all packing label warnings and handling instructions.
 6. Open termination compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.
- B. Handling:
 1. Handle transformers carefully, in accordance with manufacturer recommendations, to avoid damage to enclosure, termination compartments, base, frame, and internal components. Do not subject transformers to impact, jolting, jarring, or rough handling.
 2. Protect transformer against entrance of dust, rain, and snow.
 3. Transport transformers upright, to avoid internal stresses on core and coil mounting assembly and transformer case.
 4. Verify that transformer weights are within rated capacity of handling equipment.
 5. Use only manufacturer-recommended points for lifting, jacking, and pulling. Use all lifting lugs when lifting transformers.
 6. Use jacks only at corners of base plate of transformer case.
 7. Use nylon straps of same length to balance and distribute weight when handling transformers with a crane.
 8. Use spreaders or a lifting beam to obtain a vertical lift and to protect transformer from straps bearing against enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.

9. Exercise care not to damage base structure of case when handling transformer using skids or rollers. Use skids to distribute stresses over case base when using rollers under large transformers.
- C. Examine areas and space conditions for compliance with requirements for dry-type, medium-voltage transformers and other conditions affecting performance of the Work.
- D. Examine roughing-in of conduits and grounding systems to verify the following:
 1. Wiring entries comply with layout requirements.
 2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.
- E. Examine walls, floors, roofs, and concrete bases for suitable conditions for transformer installation. Provide 4-inch thick minimum concrete house keeping pad.
- F. Pre-Installation Checks:
 1. Verify removal of any shipping bracing after placement.
- G. Verify that ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at transformer location.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install transformers on cast-in-place concrete equipment base(s).
- B. Transformer shall be installed level and plumb and shall tilt less than 1.5 degrees while energized.
- C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526.
- B. Connect wiring according to Section 260513 "Wires and Cables."
 1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.
 2. Bundle associated phase, neutral, and equipment grounding conductors together within transformer enclosure. Arrange conductors such that there is not excessive strain that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.

- C. Terminate medium-voltage cables in incoming section according to Section 260515 "Medium-Voltage Cables."

3.4 SIGNS AND LABELS

- A. Comply with installation requirements for labels and signs specified in Section 260010.
- B. Install warning signs as required to comply with 29 CFR 1910.269.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:

1. General Field-Testing Requirements:

- a. Comply with provisions of NFPA 70B, Ch. "Testing and Test Methods."
- b. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
- c. After installing transformer but before primary is energized, verify that grounding system at substation is tested at specified value or less.
- d. After installing transformer and after electrical circuitry has been energized, test for compliance with requirements.
- e. Visual and Mechanical Inspection:
 - 1) Verify equipment nameplate data complies with Contract Documents.
 - 2) Inspect bolted electrical connections for high resistance using one of the following two methods:
 - a) Use a low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
 - b) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.12.
- f. Remove and replace malfunctioning units and retest.
- g. Prepare test and inspection reports. Record as-left set points of all adjustable devices.

2. Dry-Type Transformer Field Tests:

- a. Visual and Mechanical Inspection:

- 1) Test dew point of tank gases if applicable.
- 2) Inspect anchorage, alignment, and grounding.
- 3) Verify that resilient mounts are free and that any shipping brackets have been removed.
- 4) Verify bushings are clean.
- 5) Verify that alarm, control, and trip settings on temperature and level indicators are set and operate within manufacturer's recommended settings.
- 6) Verify that cooling fans operate correctly and have appropriate overcurrent protection.
- 7) Perform specific inspections and mechanical tests recommended by manufacturer.
- 8) Verify that as-left tap connections are as specified.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION 261216

SECTION 261323 - MEDIUM VOLTAGE SWITCHES

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specification sections “General Conditions”, “Special Requirements” and “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.
- B. The drawings and general provisions of the Contract, and other Division 1 Specification Sections, apply to work of this section.

1.2 SUMMARY

- A. This Section includes following items:
 - 1. 5kV medium voltage switches. .

1.3 SUBMITTALS

- A. Product Data: For each switch specified. Include dimensioned plans, sections, and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and materials lists.
- B. Wiring Diagrams: Details of wiring for switches and differentiating between manufacturer-installed and field-installed wiring. Show both power and control wiring.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- D. Maintenance Data: For each type of product to include in the maintenance manuals specified in Division 1. List all factory settings of relays and provide relay-setting and calibration instructions.

1.4 QUALITY ASSURANCE

- A. Emergency Service: Manufacturer maintains a service center capable of providing emergency maintenance and repairs at Project site with an 8-hour maximum response time.
- B. Source Limitations: Obtain equipment from a single manufacturer who assumes

responsibility for all components.

- C. Listing and Labeling: Provide switches specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square "D".
 - 2. Cutler Hammer.
 - 3. General Electric.

2.2 MEDIUM VOLTAGE SWITCH PRODUCT REQUIREMENTS

- A. General Line-up Description:
 - 1. Product Type: HVL/CC (Square "D").
 - 2. Metal-enclosed switchgear assembly.
 - 3. Indoor (NEMA 1).
 - 4. Label Requirements: UL.
 - 5. Padlock provisions for up to 3 padlocks on operating handle port cover.both positions
 - 6. Front access only.
- B. Ratings:
 - 1. Switchgear Maximum Voltage Rating: 4.76 KV.
 - 2. BIL: 60 KV.
 - 3. Nominal System Voltage: 4160 volts.
 - 4. Standards: ANSI.
 - 5. System Grounding: 3 wire wye solidly grounded.
 - 6. Frequency: 60 HZ.
 - 7. Fault Close Current: 40 KA ASYM (25 KA SYM).
 - 8. Main Bus Momentary Current Bracing: 40 KA ASYM (25 KA SYM).

9. Maximum HVL/CC switch 2 second short circuit. Current Rating: 40 KA ASYM (25 KA SYM).
10. Interrupting Rating: Fused Series Rating.

C. Structure Information:

1. Main Bus: 600A tin-plated copper, HVL/CC lugs are suitable for either copper or aluminum cables (UL Listed).
2. Insulators: Epoxy.
3. Paint Color: ANSI #61 (light grey).
4. 1-14.75 incoming section.
5. Overall Dimensions: 14.75" wide, 90.00" height, 37.25" deep.

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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identify components according to Section 260010.

3.2 CONNECTIONS

- A. Ground equipment as indicated and required by National Electrical Code.
 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Preliminary Tests: Perform electrical tests as recommended by manufacturer and as follows:

1. Check for electrical continuity of circuits and for short circuits.
- B. Field Tests: Give 7 days' advance notice of tests and perform tests in presence of Owner's representative.
- C. Tests: As recommended by manufacturer and as follows:
 1. Operational Tests: Demonstrate interlocking and operational function for each switch at least 3 times.
- D. Test Failures: Correct deficiencies identified by tests and prepare for retest. Verify that equipment meets specified requirements.
- E. Reports: Maintain a written record of observations and tests. Report defective materials and workmanship and retest corrected items.

3.4 DEMONSTRATION

- A. Training: Engage a factory-authorized service representative to instruct Institution's personnel in the operation, maintenance, and adjustment of transfer switches and related equipment. Provide a minimum of 4 hours of instruction scheduled 7 days in advance.

END OF SECTION 261323

SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

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 distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
 - 2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
- B. Shop Drawings:
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 - 3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.
 - 1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.
- B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.
- C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
- D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each transformer type from single source from single manufacturer.
- B. Basis of design Cutler Hammer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Comply with NFPA 70 and NEMA TP-1
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
 - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 - 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.
- D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70, and list and label as complying with UL 1561.
- B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
 - 1. One leg per phase.
 - 2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
 - 3. Grounded to enclosure.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Coil Material: Copper shielded K13
 - 2. Internal Coil Connections: Brazed or pressure type.
 - 3. Terminal Connections: Bolted.
- D. Enclosure for Transformers installed within the building interior: Ventilated.
 - 1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
 - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 - 3. Wiring Compartment: Sized for conduit entry and wiring installation.
 - 4. Finish: Comply with NEMA 250.
 - a. Finish Color: Gray weather-resistant enamel.
- E. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- F. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- G. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- H. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.
- I. Low-Sound-Level Requirements: Minimum of 3dBA less than the NEMA ST 20 Standard sound levels when factory tested according to IEEE C57.12.91.

2.4 IDENTIFICATION

- A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws.

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
 2. Ratio tests at rated voltage connections and at all tap connections.
 3. Phase relation and polarity tests at rated voltage connections.
 4. No load losses, and excitation current and rated voltage at rated voltage connections.
 5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
 6. Applied and induced tensile tests.
 7. Regulation and efficiency at rated load and voltage.
 8. Insulation-Resistance Tests:
 - a. High-voltage to ground.
 - b. Low-voltage to ground.
 - c. High-voltage to low-voltage.
 9. Temperature tests.
- B. Factory Sound-Level Tests: Conduct prototype sound-level tests on production-line products.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

- B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- C. "Basic Electrical Materials and Methods."
 - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- D. Secure transformer to concrete base according to manufacturer's written instructions.
- E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding."
- B. 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.
- C. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
- E. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection.
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.

- g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
 - c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
 - d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- F. Large (Larger Than 167-kVA Single Phase or 500-kVA Three Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
 - c. Perform power-factor or dissipation-factor tests on all windings.
 - d. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
 - e. Perform an excitation-current test on each phase.
 - f. Perform an applied voltage test on all high- and low-voltage windings to ground. See IEEE C57.12.91, Sections 10.2 and 10.9.
 - g. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- G. Remove and replace units that do not pass tests or inspections and retest as specified above.
- H. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- I. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262213

SECTION 262413 - DISCONNECT SWITCHES AND CIRCUIT BREAKERS

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 individually mounted switches and circuit breakers used for the following:
 - 1. Feeder and equipment disconnect switches.
 - 2. Feeder branch-circuit protection.
 - 3. Motor disconnect switches.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and General Requirements.
- B. Product Data for disconnect switches, circuit breakers, and accessories specified in this Section.

1.4 QUALITY CONTROL

- A. Testing Agency Qualifications: In addition to the requirements specified in Division 1 Section "Quality Control," an independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be a full member company of the InterNational Electrical Testing Association (NETA).
 - 1. Testing Agency's Field Supervisor: Person currently certified by NETA or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.
- C. Comply with NFPA 70 for components and installation.
- D. Listing and Labeling: Provide disconnect switches and circuit breakers specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering disconnect switches and circuit breakers that may be incorporated into the Work include, but are not limited to, the following:
 1. Switches:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution and Control Division.
 - c. Square D Co.
 2. Molded-Case Circuit Breakers:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution and Control Division.
 - c. Square D Co.

2.2 DISCONNECT SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position.
- C. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
 1. Outdoor Locations: Type 3R.
 2. Other Wet or Damp Indoor Locations: Type 4.

2.3 ENCLOSED CIRCUIT BREAKERS

- A. Enclosed, Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle.
- B. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting rating to meet available fault current.
- C. Application Listing: Appropriate for application, including switching fluorescent lighting loads or heating, air-conditioning, and refrigerating equipment.
- D. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.

- E. Circuit Breakers, 350A and Larger: Field-adjustable, electronic, long time ,short time and instantaneous settings.
- F. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
- G. Accessories: As indicated.
- H. Enclosure: NEMA AB 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
 - 1. Outdoor Locations: Type 3R.
 - 2. Other Wet or Damp Indoor Locations: Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.
- B. Install disconnect switches and circuit breakers level and plumb.
- C. Install wiring between disconnect switches, circuit breakers, control, and indication devices.
- D. Connect disconnect switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Identify each disconnect switch and circuit breaker according to requirements specified in Division 26 Sections.

3.2 FIELD QUALITY CONTROL

- A. Testing: After installing disconnect switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
- B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.3 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

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 lighting and power panelboards and associated auxiliary equipment rated 600 V or less.
- B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section:
 - 1. "Overcurrent Protective Devices" for circuit breakers, fusible switches, fuses, and other devices used in panelboards.

1.3 DEFINITIONS

- A. Overcurrent Protective Device (OCPD): A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and General Requirements.
- B. Product data for each type panelboard, accessory item, and component specified.
- C. Shop drawings from manufacturers of panelboards including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:
 - 1. Enclosure type with details for types other than NEMA Type 1.
 - 2. Bus configuration and current ratings.
 - 3. Short-circuit current rating of panelboard.
 - 4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
- D. Report of field tests and observations certified by the testing organization.
- E. Panel schedules for installation in panelboards. Submit final versions after load balancing.

- F. Maintenance data for panelboard components, for inclusion in Operating and Maintenance Manual specified in Division 01 and in Division 26 Section "Basic Electrical Requirements." Include instructions for testing circuit breakers.

1.5 QUALITY CONTROL

- A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- B. Field-Testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.
- C. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code."
- D. NEMA Standard: Comply with NEMA PB1, "Panelboards."
- E. UL Standards: Comply with UL 61, "Panelboards," and UL 50, "Cabinets and Boxes."

1.6 EXTRA MATERIALS

- A. Keys: Furnish six spares of each type for panelboard cabinet locks.
- B. Touch-up Paint for surface-mounted panelboards: One half-pint (235 mL) container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers:
 - 1. Square D Co.
 - 2. Cutler Hammer
 - 3. General Electric

2.2 PANELBOARDS, GENERAL REQUIREMENTS

- A. Overcurrent Protective Devices (OCPDs): Provide type, rating, and features as indicated. Comply with Division 16 Section "Overcurrent Protective Devices," with OCPDs adapted to panelboard installation. Tandem circuit breakers shall not be used. Multipole breakers shall have common trip.

- B. Enclosures: Cabinets, flush or surface mounted as indicated. NEMA Type 1 enclosure, except where the following enclosure requirements are indicated.
 - 1. NEMA 3R: Raintight.
- C. Front: Secured to box with concealed trim clamps except as indicated. Front for surface-mounted panels shall be same dimensions as box. Fronts for flush panels shall overlap box except as otherwise specified.
- D. Directory Frame: Metal, mounted inside each panel door.
- E. Bus: Hard drawn copper of 98 percent conductivity.
- F. Main and Neutral Lugs: Compression type.
- G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.
- H. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the OCPD ampere ratings indicated for future installation of devices.
- I. Special Features: Provide the following features for panelboards as indicated.
 - 1. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.

2.3 LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

- A. Branch OCPDs: Bolt-on circuit breakers, replaceable without disturbing adjacent units. Minimum AIC shall be 22,000 amps.
- B. Double-Width Panels: Where more than 42 poles are indicated or where otherwise indicated, provide two panelboards under single front.
- C. Doors: In panel front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.
- D. Transient Voltage Suppression Device: IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.
 - 1. Minimum Single-Impulse Current Ratings:
 - a. Line to Neutral: 100,000
 - b. Line to Ground: 100,000
 - c. Neutral to Ground: 50,000
 - 2. Protection modes shall be as follows:
 - a. Line to neutral.
 - b. Line to ground.
 - c. Neutral to ground.

3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55dB at 100kHz.
4. Maximum Category C Combination Wave Clamping Voltage: 600 V, line to neutral and line to ground on 120/208 V systems.
5. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
6. Accessories:
 - a. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
 - b. Audible alarm activated on failure of any surge diversion module.

2.4 DISTRIBUTION PANELBOARDS

- A. Doors: In panel front, omit single panelboard door in cabinet front for fusible switch panelboards except as indicated. Secure with vault-type with tumbler lock, all keyed alike.
- B. Branch-Circuit Breakers: Where OCPDs are indicated to be circuit breakers, use bolt-on breakers except circuit breakers 225-ampere frame size and greater may be plug-in type where individual positive locking device requires mechanical release for removal. Minimum AIC shall be 30,000 amps.

2.5 IDENTIFICATION

- A. General: Refer to Section 260055 for labeling materials.
- B. Panelboard Nameplates: Engraved laminated plastic or metal nameplate for each panelboard mounted with epoxy or industrial cement or industrial adhesive.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install panelboards and accessory items in accordance with NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less" and manufacturers' written installation instructions.
- B. Ground Fault Protection: Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289, "Application Guide for Ground Fault Circuit Interrupters."
- C. Mounting Heights: Top of trim 74 inches above finished floor, except as indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount flush panels uniformly flush with wall finish.
- E. Circuit Directory: Typed and reflective of final circuit changes required to balance panel loads. Obtain approval before installing.
- F. Install filler plates in unused spaces.

- G. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch empty conduits from panel into accessible ceiling space or space designated to be ceiling space in future. Stub four 1-inch empty conduits into raised floor space or below slab other than slabs on grade.
- H. Wiring in Panel Gutters: Train conductors neatly in groups, bundle, and wrap with wire ties after completion of load balancing.

3.2 IDENTIFICATION

- A. Identify field-installed wiring and components and provide warning signs in accordance with Division 26
- B. Section "Electrical Identification."

3.3 GROUNDING

- A. Connections: Make equipment grounding connections for panelboards as indicated.
- B. Provide ground continuity to main electrical ground bus indicated.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Visual and Mechanical Inspection: Include the following inspections and related work:
 - 1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
 - 2. Exercise and perform of operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
 - 3. Check panelboard mounting, area clearances, and alignment and fit of components.
 - 4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
 - 5. Perform visual and mechanical inspection and related work for overcurrent protective devices as specified in Division 26 Section "Overcurrent Protective Devices."

3.6 CLEANING

- A. Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

- A. Balancing Loads: After Substantial Completion, but not more than two months after Final Acceptance, conduct load-balancing measurements and circuit changes as follows:
1. Perform measurements during period of normal working load as advised by the Department.
 2. Perform load-balancing circuit changes outside the normal occupancy/working schedule of the facility. Make special arrangements with Department to avoid disrupting critical 24-hour services such as FAX machines and on-line data processing, computing, transmitting, and receiving equipment.
 3. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.
 4. Tolerance: Difference between phase loads exceeding 20 percent at any one panelboard is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

END OF SECTION 262416

SECTION 263213 - PACKAGED ENGINE GENERATORS

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specification sections “General Conditions of Contract”, “Special Conditions” and “Division 01 – 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 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes requirements for an exterior emergency power supply generator with the following features:
 - 1. Natural Gas fueled engine.
 - 2. The starting and running kW/kVA capacity of the generator shall be based on natural gas fuel.
 - 3. Refer to the drawings for additional requirements including those listed on the single line diagram for minimum kW/kVA rating, minimum starting kVA requirement at 30 percent instantaneous voltage drop.
 - 4. Unit-mounted cooling system.
 - 5. Provide a PMG Exciter.
 - 6. Remote-mounting control, monitoring, and emergency stop.
 - 7. Outdoor skintight sound attenuated enclosure that limits the average db sound output of the generator at full load to 72 dbA at 7 meters.
 - 8. Battery charger located on the generator skid.
 - 9. Provide engine coolant block heater.
 - 10. The unit is required to include a sound attenuating exhaust air scoop.
 - 11. The engine exhaust muffler shall be internally mounted within the enclosure.
 - 12. Contractor shall provide a temporary loadbank for the required testing of the generator.
- B. Related Sections include the following:
 - 1. Section 263600 “Transfer Switches” for transfer switches including sensors and relays to initiate automatic-starting and stopping signals for engine-generator sets.

1.4 DEFINITIONS

- A. 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.
- B. LP: Liquid Petroleum.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - 1. Thermal damage curve for generator.
 - 2. Provide the Starting kVA versus Voltage Drop locked rotor curve for the Alternator that shows the available starting kVA for the generator at 30 percent voltage drop.
 - 3. Coordinate the requirements of the Life Safety Selectively Coordinated Circuit Breaker as shown on single line .
 - 4. Time-current characteristic curves for generator overcurrent protective devices.
 - 5. Coordinate with the Short Circuit and Coordination Study requirements and include a listed circuit breaker recommended in that study for the Life Safety Power Distribution System that achieves selective coordination.
 - 6. Include the maximum dbA output of the generator when it is installed in the sound attenuated enclosure that will be provided with the generator, indicating compliance with the requirement for a maximum sound output of 74dbA at 7 meters.
 - 7. Failure to provide any of the above items will result in a rejected shop drawing submittal.
- 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. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
 - 2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
 - 4. Wiring Diagrams: Power, signal, and control wiring.

1.6 INFORMATION SUBMITTALS

- A. Qualification Data: For installer and testing agency.
- B. Source quality-control test reports.
 - 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, showing evidence of compliance with specified requirements.
 4. Report of sound generation.
 5. Report of exhaust emissions showing compliance with applicable regulations.
 6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- C. Field quality-control test reports.
- D. Warranty: Special warranty specified in this Section.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.
1. 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.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- 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. 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.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
 2. Engineering Responsibility: Preparation of data for vibration isolators, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training parts, and emergency maintenance repairs.
- C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- E. 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.
- F. Comply with ASME B15.1.
- G. Comply with NFPA 37.
- H. Comply with NFPA 70.
- I. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- J. Comply with UL 2200.
- K. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

1.10 PROJECT CONDITIONS

- 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 according to requirements indicated:
 1. Notify Engineer and Owner no fewer than three (3) days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without Engineer's written permission.

1.11 COORDINATION

- A. Coordinate size and location of bases for package engine generators.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which 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.

1.13 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers are limited to, the following:
 - 1. MTU Onsite Energy.
 - 2. Kohler.
 - 3. Onan Cummins.
 - 4. Caterpillar.
 - 5. Or approved equal.

2.2 ENGINE-GENERATOR SET

- A. Factory-assembled and tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments. Maximum length shall not exceed 21 feet.
- C. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
 - 2. Output Connections: Three-phase, four wire.
 - 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- D. Generator-Set 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 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

2.3 ENGINE

- A. Fuel: Natural Gas fueled engine.
- B. Rated Engine Speed: 1800 rpm.
- C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.
- D. Lubrication System: The following items are mounted on engine or skid:
 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.
- E. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
- F. Engine Fuel System:
 1. Natural Gas:
 - a. Carburetor.
 - b. Secondary Gas Regulators.
 - c. Fuel Shutoff Solenoid Valves.
 - d. Flexible Fuel Connectors.
- G. Governor: Adjustable isochronous, with speed sensing.
- H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set 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. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 4. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging, ultraviolet, and abrasion-resistant fabric.
 - a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and non-collapsible under vacuum.
 - b. End Fittings: Flanges and steel pipe nipples with clamps to suit piping and equipment connections.
- I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Provide sound attenuated muffler that facilitates the maximum dbA sound output requirements of the engine and generator as listed in this specification.
- J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- K. Starting System: 24-V electric, with negative ground.
1. Components: Sized so they will not be damaged during a full engine-cranking cycle.
 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: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging. Batteries shall be Ni-Cad
 5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C. Include accessories required to support and fasten batteries in place.
 7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
 8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
 - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again. LaMarche A-46F accessory package CAP

- b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
- c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
- d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
- 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.

2.4 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 generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
 - 1. AC voltmeter.
 - 2. AC ammeter.
 - 3. AC frequency meter.
 - 4. DC voltmeter (alternator battery charging).
 - 5. Engine-coolant temperature gage.
 - 6. Engine lubricating-oil pressure gage.
 - 7. Running-time meter.
 - 8. Ammeter-voltmeter, phase-selector switch(es).
 - 9. Generator-voltage adjusting rheostat.
 - 10. Start-stop switch.
 - 11. Over speed shutdown device.
 - 12. Coolant high-temperature shutdown device.
 - 13. Coolant low-level shutdown device.
 - 14. Oil low-pressure shutdown device.
- D. 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.

- E. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
 - 1. Over crank shutdown.
 - 2. Coolant low-temperature alarm.
 - 3. Control switch not in auto position.
 - 4. Battery-charger malfunction alarm.
 - 5. Battery low-voltage alarm.
- F. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.
 - 1. Engine high-temperature shutdown.
 - 2. Lube-oil, low-pressure shutdown.
 - 3. Over speed shutdown.
 - 4. Remote emergency-stop shutdown.
 - 5. Engine high-temperature pre-alarm.
 - 6. Lube-oil, low-pressure pre-alarm.
 - 7. Low coolant level.
- G. Remote Alarm Annunciator: Comply with NFPA 99. An LED 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.
- H. Remote Emergency-Stop Switch: Wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: For the Standby Power feeder, provide molded-case, electronic 100 percent rated; complying with NEMA AB 1 and UL 489. Provide the Life Safety circuit breaker for selective coordination
 - 1. Tripping Characteristic: Designed specifically for generator protection.
 - 2. Trip Rating: Matched to generator rating.
 - 3. Mounting: Adjacent to or integrated with control and monitoring panel.

2.6 GENERATOR, PMG-EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. The PMG Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.

- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Drip proof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: An outdoor skintight sound attenuated level 2 enclosure that limits the average db sound output of the generator at full load. A vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
 - 1. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
 - 2. Hinged Doors: With padlocking provisions.
 - 3. Muffler Location: Within enclosure.
- B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates.
 - 1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.

2.8 VIBRATION ISOLATION DEVICES

- A. Restrained Spring Isolators.
 - 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-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.

2.9 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.10 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

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 of 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 INSTALLATION

- A. Comply with packaged engine-generator manufacturer's written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator on equipment bases.
- D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

- B. Connect cooling-system water piping to engine-generator set and heat exchanger with flexible connectors.
- C. Connect engine exhaust pipe to engine with flexible connector.
- D. Ground equipment according to Section 260526 "Grounding and Bonding."
- E. Connect wiring according to Section 260513 "Conductors and Cables."

3.4 IDENTIFICATION

- A. Identify system components according to Division 26 Section 260510

3.5 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. Report results in writing.
- B. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection (except those indicated to be optional) for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 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 according to 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 Emissions Test: Comply with applicable government test criteria.
 - 7. 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.

8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 9. 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 on the property line, 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 standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
 - E. Leak Test: After installation, charge system 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.
 - G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - H. Remove and replace malfunctioning units and retest 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.
 - K. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.
 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213

SECTION 263600 - TRANSFER SWITCHES

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 transfer switches rated 600 V and less, including the following:
 - 1. Automatic Transfer Switch (ATS).

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
 - 2. Include material lists for each switch specified.
 - 3. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
 - 4. Riser Diagram: Show interconnection wiring between transfer switches, bypass/isolation switches, annunciators, and control panels.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer-authorized service representative.
- B. Seismic Qualification Data: Certificates, for transfer switches, 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: Identify center of gravity 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. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in "Operation and Maintenance Data," include the following:
 - a. Features and operating sequences, both automatic and manual.
 - b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications:

1. Member company of NETA.
 - a. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 FIELD CONDITIONS

- 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:
1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without Owner's written permission.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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. Comply with NEMA ICS 1.
- C. Comply with NFPA 99.
- D. Comply with NFPA 110.
- E. Comply with UL 1008 unless requirements of these Specifications are stricter.
- F. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- G. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
 - 2. Short-time withstand capability for three cycles.
- H. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- I. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.
- K. Service-Rated Transfer Switch:
 - 1. Comply with UL 869A and UL 489.
 - 2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
 - 3. In systems with a neutral, the bonding connection shall be on the neutral bus.
 - 4. Provide removable link for temporary separation of the service and load grounded conductors.
 - 5. Service Disconnecting Means: Externally operated, manual mechanically actuated.
- L. Neutral Switching: Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

- M. Neutral Terminal: Solid and fully rated unless otherwise indicated.
- N. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.
- O. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- P. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- Q. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
 - 4. Accessible via front access.
- R. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 MOLDED-CASE-TYPE AUTOMATIC TRANSFER SWITCHES

- A. Manufacturers:
 - 1. Onan.
 - 2. Kohler.
 - 3. Eaton.
- B. Comply with Level 1 equipment according to NFPA 110.
- C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources. Service entrance approved for utility source.
 - 1. Limitation: Switches using contactor-based components are unacceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching.
 - 4. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 5. Material: Hard-drawn copper, 98 percent conductivity.
 - 6. Main and Neutral Lugs: Mechanical type.
 - 7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 8. Ground bar.
 - 9. Connectors shall be marked for conductor size and type according to UL 1008.

- D. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.
 - 1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
- E. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.
 - 1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from zero to six seconds, and factory set for one second.
 - 2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
 - 3. Fully automatic break-before-make operation with center off position.
 - 4. Fully automatic break-before-make operation with transfer when two sources have near zero phase difference.
- F. Automatic Closed-Transition Transfer Switches: Connect both sources to load momentarily. Transition is controlled by programming in the automatic transfer-switch controller.
 - 1. Fully automatic make-before-break operation when transferring between two available power sources.
 - 2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
 - 3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
 - a. Initiation occurs without active control of generator.
 - b. Automatic transfer-switch controller takes active control of generator to match frequency, phase angle, and voltage.
 - c. Controls ensure that closed-transition load transfer closure occurs only when the two sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
 - 4. Failure of power source serving load initiates automatic break-before-make transfer.
- G. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- H. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- I. Electric Nonautomatic Switch Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.

- J. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.
- K. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.
- L. Transfer Switches Based on Molded-Case-Switch Components: Comply with UL 489 and UL 869A.
- M. Automatic Transfer-Switch Controller Features:
 - 1. Controller operates through a period of loss of control power.
 - 2. Undervoltage Sensing for Each Phase of Normal and Alternative Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - 4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - 5. Test Switch: Simulate normal-source failure.
 - 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 - 8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 - 9. 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.
 - 10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
 - 11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
 - 12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
 - 13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

- a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
 - c. Integral battery operation of time switch when normal control power is unavailable.
- N. In phase monitor.
- O. Elevator pre/post relays provide wiring to elevator controller as required.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. 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.
- B. Prepare test and inspection reports.
 - 1. For each of the tests required by UL 1008, performed on representative devices, for legally required systems. Include results of test for the following conditions:
 - a. Overvoltage.
 - b. Undervoltage.
 - c. Loss of supply voltage.
 - d. Reduction of supply voltage.
 - e. Alternative supply voltage or frequency is at minimum acceptable values.
 - f. Temperature rise.
 - g. Dielectric voltage-withstand; before and after short-circuit test.
 - h. Overload.
 - i. Contact opening.
 - j. Endurance.
 - k. Short circuit.
 - l. Short-time current capability.
 - m. Receptacle withstand capability.
 - n. Insulating base and supports damage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall-Mounting Switch: Anchor to wall by bolting.
 - 1. Provide workspace and clearances required by NFPA 70.
- B. Identify components according to Section 260553 "Identification for Electrical Systems."
- C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

- D. Comply with NECA 1.

3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
 - 1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
- D. Ground equipment according to Section 260526 "Grounding."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing equipment, test for compliance with requirements according to NETA ATS.
 - 2. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with Drawings and Specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and required clearances.
 - d. Verify that the unit is clean.
 - e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - f. Verify that manual transfer warnings are attached and visible.
 - g. Verify tightness of all control connections.
 - h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
 - 1) Use of low-resistance ohmmeter.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
 - i. Perform manual transfer operation.
 - j. Verify positive mechanical interlocking between normal and alternate sources.

- k. Perform visual and mechanical inspection of surge arresters.
- l. Inspect control power transformers.
 - 1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
 - 2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
 - 3) Verify correct functioning of draw out disconnecting contacts, grounding contacts, and interlocks.
- 3. Electrical Tests:
 - a. Perform insulation-resistance tests on all control wiring with respect to ground.
 - b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
 - c. Verify settings and operation of control devices.
 - d. Calibrate and set all relays and timers.
 - e. Verify phase rotation, phasing, and synchronized operation.
 - f. Perform automatic transfer tests.
 - g. Verify correct operation and timing of the following functions:
 - 1) Normal source voltage-sensing and frequency-sensing relays.
 - 2) Engine start sequence.
 - 3) Time delay on transfer.
 - 4) Alternative source voltage-sensing and frequency-sensing relays.
 - 5) Automatic transfer operation.
 - 6) Interlocks and limit switch function.
 - 7) Time delay and retransfer on normal power restoration.
 - 8) Engine cool-down and shutdown feature.
- 4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
- 5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.

- e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
 - g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
 - 6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.
 - C. Coordinate tests with tests of generator and run them concurrently.
 - D. 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.
 - E. Transfer switches will be considered defective if they do not pass tests and inspections.
 - F. Remove and replace malfunctioning units and retest as specified above.
 - G. Prepare test and inspection reports.
 - H. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
 - 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
 - 3. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
- 3.4 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
 - B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

SECTION 283111 - DIGITAL ADDRESSABLE FIRE ALARM

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specification sections "General Conditions", "Special Requirements", and "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 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes requirements for the modification and expansion of an existing fire alarm system. The existing Fire Alarm System is a Johnson/Simplex System. All design requirements for the modification and expansion shall be of a delegated design by the Fire Alarm System vendor. The delegated design shall include any upgrading of the existing main fire alarm system head end and the installation of fiber optic cabling as required. Final locations of all fire alarm equipment shall be the full responsibility of the Prime electrical contractor and the Fire Alarm System vendor. Any and all interfacing work with the client's existing IT fiber system shall be coordinated by the Prime electrical contractor and client's IT department and the work shall be the full responsibility of the Prime electrical contractor.
- B. All equipment and material provided for the fire alarm system shall be fully compatible with the existing system.
- C. Coordinate with the equipment manufacturer and provide all required equipment, labor and material at the existing Main Fire Alarm Control Panel to expand the existing system to include all of the fire alarm devices shown on the drawings.
- D. For each additional fire alarm system control panel or power supply panel provided by the Fire Alarm Vendor (beyond what is shown on the drawings) for their final system design, provide an additional 120V branch circuits (2#12, 1#12G, 3/4"C) to the nearest 120/208V panelboard and a smoke detector above each panel.
- E. After the modifications to the existing fire alarm system are complete, the fire alarm system shall pass a 100% re-acceptance test and comply with the requirements of the Local Authority Having Jurisdiction and NFPA 72.

1.4 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.5 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified addressable system, with multiplexed signal transmission and combination voice/strobe evacuation.
 - 1. Interface with existing fire alarm system.
 - 2. Interface with sprinkler system preaction panel and fire pumps.
- B. Provide Modifications and additions to the existing Simplex fire alarm panel.

1.6 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72. and IBC 2015
- B. Fire alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
- C. Fire alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances, including voice evacuation notices.
 - 2. Identify alarm at the FACP and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
 - 5. Activate the voice/alarm communication system.
 - 6. Record events in the system memory.
 - 7. Record events by the system printer.
- D. System trouble signal initiation shall be by one or more of the following devices or actions:
 - 1. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
 - 2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
 - 3. Loss of primary power at the FACP.
 - 4. Ground or a single break in FACP internal circuits.

5. Abnormal ac voltage at the FACP.
 6. A break in standby battery circuitry
 7. Voice signal amplifier failure..
 8. Failure of battery charging.
 9. Abnormal position of any switch at the FACP or annunciator.
- E. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP and remote annunciators. Record the event on system printer.

1.7 SUBMITTALS

- A. Delegated design submittal for fire alarm system indicated to comply with performance requirement, and design criteria signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings:
1. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 - b. Fire alarm certified by NICET, minimum Level III.
 2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 3. Device Address List: Coordinate with final system programming.
 4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
 5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
 6. Batteries: Size calculations.
 7. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 8. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- D. Qualification Data: For Installer.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Institution's manual. Include abbreviated operating instructions for mounting at the FACP.

- G. The shop drawings shall include signed and sealed (By a NICET qualified Professional Engineer) floorplans (showing the locations of all devices), wiring diagrams, riser diagrams, battery calculations and all additional NFPA 72 requirements.
- H. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 01 Section "Submittals," make an identical submittal to authorities having jurisdiction (Pennsylvania Department of Labor & Industry) for review and approval prior to submission to the Professional. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Professional for review.
- I. Documentation:
 - 1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Institution, Professional, and authorities having jurisdiction.
 - 2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Institution, Professional, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
 - a. Hard copies on paper to Institution, Professional, and authorities having jurisdiction.

1.8 QUALITY CONTROL

- A. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level II.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.9 PROJECT CONDITIONS

- A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by Institution or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - 1. Notify Owner no fewer than five days in advance of proposed interruption of fire alarm service.
 - 2. Do not proceed with interruption of fire alarm service without Owner's written permission.

1.10 SEQUENCING AND SCHEDULING

- A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

- B. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment.

1.11 EXTRA MATERIALS

- A. Furnish extra materials to match products installed. :
 - 1. Fifteen (15) each of the following:
 - a. Heat detectors, monitor modules and control modules.
 - b. Address devices and notification devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. The existing Fire Alarm System is Simplex., This item has been approved as a proprietary item. No other item will be accepted. Substitution sections of the General Conditions to be Construction Contract do not apply to this item.
 - 2. An authorized distributor to meet the qualifications of these specifications shall be used
 - 3. Wire and Cable:
 - a. Comtran Corporation.
 - b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
 - c. West Penn Wire/CDT; a division of Cable Design Technologies.

2.2 EXISTING FIRE ALARM SYSTEM

- A. Compatibility with Existing Equipment: Fire alarm system and components shall operate as an extension of an existing system.

2.3 FACP

- A. General Description:
 - 1. Modular, power-limited design with electronic modules, UL 864 listed.
 - 2. Addressable initiation devices that communicate device identity and status.
 - 3. Addressable control circuits for operation of mechanical equipment.

- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
- C. Circuits:
 - 1. Signaling Line Circuits: NFPA 72, Class A, Style 7.
 - 2. Notification-Appliance Circuits: NFPA 72, Class A, Style Z.
 - 3. Actuation of alarm notification appliances, annunciation, and actuation of suppression systems shall occur within 10 seconds after the activation of an initiating device.
- D. Notification-Appliance Circuit: Alarm using horns and horn strobe units.
- E. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.
- F. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP, after initiating devices are restored to normal.
 - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
 - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
 - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- G. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the system printer.
- I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.

- J. Service Modem: Ports shall be RS-232 for system printer and for connection to a dial-in terminal unit.
 - 1. The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.
- K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble), and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including the same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- L. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 SYSTEM SMOKE DETECTORS

A. General Description:

- 1. UL 268 listed, operating at 24-V dc, nominal.
- 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- 3. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
- 4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- 5. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
- 6. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
 - a. Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F.
 - c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

- 1. Sensor: LED or infrared light source with matching silicon-cell receiver.

2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

2.5 HEAT DETECTORS

- A. General: UL 521 listed.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or rate-of-rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.
 1. Mounting: Adapter plate for outlet box mounting.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.
 1. Mounting: Adapter plate for outlet box mounting.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 NOTIFICATION APPLIANCES

- A. Description: Equipped for mounting as indicated and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
- B. Tone Notification Appliances:
 1. Comply with UL 1480.
 2. Horn for Notification: Locate horns for notification to provide 95 dBA sound output.
 3. Mounting: Surface..
- C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
 1. Rated Light Output: 15 to 75 candela adjustable.
 2. Strobe Leads: Factory connected to screw terminals.

2.7 REMOTE ANNUNCIATOR

- A. Modify existing for added addresses and reprogram.

2.8 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal.

2.9 NAC PANEL POWER SUPPLY

- A. Provide UL listed notification appliance extender with battery back up in NEMA 1 enclosure.
- B. Panel shall provide 6 amps of 24 VDC power with 4 notification appliance circuits.

2.10 PREACTION PANEL

- A. Provide preaction fire control panel Simplex 4100ES for sprinkler system releasing control.
- B. Provide suppression release devices, maintenance devices, and supervision modules for each zone and preaction valve.
- C. Provide wiring per manufacturers recommendations.

2.11 WIRE AND CABLE

- D. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- E. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
- F. Non-Power-Limited Circuits: Solid-copper conductors in raceway with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.
 - 1. Connect new equipment to the existing control panel in the existing part of the building.
 - 2. Connect new equipment to the existing monitoring equipment at the Supervising Station.
 - 3. Expand, modify, and supplement the existing equipment as necessary to extend the existing functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.
- B. Smoke or Heat Detector Spacing:
 - 1. Smooth ceiling spacing shall not exceed 30 feet.
 - 2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
 - 3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.
- C. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- D. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- E. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 WIRING INSTALLATION

- A. Install wiring according to the following:
 - 1. NECA 1.
 - 2. TIA/EIA 568-A.
- B. Wiring Method: Install wiring in metal raceway according to Division 26.
 - 1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal

points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- G. Provide fiber optic cable and connections from preaction panels and tie to the building fiber optic network.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26.
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.4 GROUNDING

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing. Program new and existing equipment as required.
- B. Perform the following field tests and inspections and prepare test reports:

1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
 - a. Include the existing system in tests and inspections.
3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.
- B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Institution's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 01.

END OF SECTION 283111

APPENDIX O

Delaware County Political Contribution Disclosure Form

Background: Under Section 6-12.E of the Administrative Code of Delaware County, Contractors under certain Covered Contracts are required to provide this Disclosure Form in connection with consideration of approval of such Covered Contract by County Council. ***Definitions of Contractor, Covered Contract, and certain other terms used in this Disclosure Form, as well as additional instructions for its completion, are set forth in Exhibit A attached hereto.***

Political Contribution Disclosure: Within the past twenty-four (24) months, Contractor* has:

_____ **NOT** made any Reportable Contributions.

_____ made Reportable Contributions as set forth on Schedule A attached hereto.

**Includes entities and persons related to a Contractor whose contributions are also required to be reported, as further described in the definition of "reportable contribution" on Exhibit A.*

Type of Business Entity

Corporation _____	LLC _____	Sole Proprietorship _____	Other: _____ (describe)
Limited Partnership _____	Partnership _____	LLP _____	_____

Certification: In order for this Disclosure Form to be considered validly submitted, it must be properly signed by the Contractor or an officer or employee of the Contractor that is authorized to make this certification. Disclosure Forms that are not properly signed will not be considered as responsive to the requirements of the Delaware County Administrative Code.

By executing below, you:

- (1) Declare and certify that you are the Contractor or an employee or officer of the Contractor and duly authorized to execute this Disclosure Form.
- (2) Represent and warrant that, to the best of your knowledge after appropriate inquiry, all of the information and disclosures provided are true and contain no material misstatement or omissions.
- (3) Acknowledge and agree to comply with the provisions described in Exhibit A.

Name of Contractor: _____

By: _____

Name:

Title:

Date:

Exhibit A
Delaware County
Political Contribution Disclosure Form

Definitions and Instructions

Timing.

Contracts subject to an RFP/Q, Invitation to Bid or other Solicitation – the Solicitation will have explicit instructions on when and how to submit this Disclosure Form. Please follow those instructions.

Other Contracts -- Disclosure Forms must be received by the County at least eight (8) days prior to the County Council meeting at which the approval of a contract will be considered. They should be submitted by e-mail to CentralPurchasing@co.delaware.pa.us.

In either case, failure to timely provide this Disclosure Form may delay consideration of your contract by County Council.

Public Posting; Right to Know Law.

The Disclosure Form for the selected Contractor is sought will be posted on the County website prior to the County Council meeting at which approval of the Covered Contract will be considered and included in the Agenda materials for such meeting.

The County will also provide copies of Disclosure Forms (whether or not the Contractor is awarded a Covered Contract) in response to requests under the Pennsylvania Right to Know Law.

Ongoing Reporting.

By January 30 of each year, commencing January 1, 2023, each Covered Contractor under a Covered Contract with a term exceeding one year is required to provide the County Clerk with an updated Disclosure Form showing any reportable contributions in the prior year or indicating that there are none. If a Contractor does not provide the required disclosure form within thirty (30) days of written notification from the County Solicitor of its failure to timely provide such form, the applicable Covered Contract is subject to being voided by County Council.

Penalties.

Any Contractor which fails to provide the Disclosure Form or which submits a Disclosure Form which is materially inaccurate may be banned as a contractor or subcontractor to the County for a period of up to three (3) years, and/or, to the extent legally permitted, the covered contract in question may be terminated, in each case, by a majority vote of County Council following such investigation and consideration of such evidence as County Council deems appropriate or by action of such other entity or body as may be designated by resolution of County Council.

Definitions.

“Contractor” means any non-governmental person, corporation, partnership, association or other entity, whether or not for profit, and includes any subcontractor which is reasonably anticipated to receive compensation of \$50,000 or more under the applicable Covered Contract. ***See the definition of “Reportable Contribution” below for entities and persons related to a contractor whose contributions are also required to be reported.***

“Covered Candidate” means any individual who seeks nomination or election to the following offices by vote of the electorate (whether or not such individual is nominated or elected): (1) County Council, District Attorney, Sheriff, Controller or Register of Wills in Delaware County; (2) Judge of the Court of Common Pleas of Delaware County or the Magisterial District Courts of Delaware County; (3) any seat in the Pennsylvania General Assembly which represents residents of Delaware County; or (4) any state-wide office in Pennsylvania (non federal).

An individual shall be deemed to be seeking nomination or election to an office if such individual has:

- (1) received a contribution or made an expenditure or given consent for any other person or committee to receive a contribution or make an expenditure for the purpose of influencing his nomination or election to such office, whether or not the individual has announced the specific office for which he or she will seek nomination or election at the time the contribution is received or the expenditure is made; or
- (2) taken the action necessary under the laws of Pennsylvania to qualify for nomination or election to such office.

The term shall include individuals nominated or elected as write-in candidates unless they resign such nomination or elected office within 30 days of having been nominated or elected.

“Covered Contract” means any contract, agreement, memorandum of understanding or other arrangement which is (i) required to be approved by County Council and (ii) under which a Covered Contractor provides or leases goods, supplies, materials, equipment, consulting, professional or other services, and/or property to the County, whether or not payments under the Covered Contract are anticipated to be made from general revenues or another specified source of funds, but does not include grant agreements under which the County is the grantee.

“Political contribution” means any advance, conveyance, deposit, distribution, transfer of funds, loan, payment, pledge, purchase of a ticket to a testimonial or similar fund-raising affair, or subscription of money or anything of value, except volunteer services, in connection with a political campaign, and any contract, agreement, promise or other obligations, whether or not legally enforceable, to make a political contribution.

“Reportable Contribution” means a political contribution, to:

- (A) A Covered Candidate.
- (B) Any Pennsylvania state committee of a political party, any County committee of a political party or any committee of a political party established at the municipal level for a municipality in the County.
- (C) A contribution to a political action committee with the intent or expectation that some or all of such contribution will be directed to a covered candidate. This intent shall be presumed if a political action committee only supports one or more covered candidates.
- (D) A contribution to a political action committee controlled by a person or entity described in clauses (1) through (5) below.

Reportable contributions include contributions by: (1) a Contractor; (2) any corporate parent, subsidiary or other affiliate of a Contractor; (3) an officer or director of a Contractor; (4) a shareholder or partner of a Contractor with a 5% or greater ownership interest; and (5) the spouse of any person or entity listed in the preceding clauses; and shall also include any contribution reimbursed by a person or entity listed in clauses (1) through (5).

Questions.

Questions regarding the Disclosure Form may be directed to CentralPurchasing@co.delaware.pa.us.

**Schedule A
Delaware County
Political Contribution Disclosure Form**

Reportable Contributions within Past 24 Months

Name of Contractor: _____

Date: _____

<u>Contributor*</u>	<u>Candidate</u>	<u>Date</u>	<u>Amount</u>	<u>Relationship of Contributor to Contractor</u>

**Reporting required for Contractor and all other entities and persons related to Contractor whose contributions are also required to be reported, as further described in the definition of “reportable contribution” on Exhibit A.*