Project Manual

Middletown Thrall Library

Contract Documents and Technical Specifications

HVAC UPGRADES

Owner:
Middletown Thrall Library
11 Depot Street
Middletown, New York 10940

Prepared By:
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MIDDLETOWN THRALL LIBRARY
MIDDLETOWN, NEW YORK 10940

HVAC UPGRADES

The Owner will receive sealed Bids for the above project until 2:00 PM prevailing time on Thursday, March 21, 2024. All Bids must be delivered to an individual in the Director's Office at Middletown Thrall Library, 11-19 Depot Street, Middletown, New York 10940

Bids received after the aforementioned time will not be accepted.

All bid envelopes must be marked "BID PROPOSAL TO BE OPENED THURSDAY, MARCH 21, 2024". It is the responsibility of the bidder to ensure that their Bid is delivered to an individual at Thrall Library.

All interested parties are invited to attend the Bid opening. Bids will be publicly opened and read aloud at 2:00 PM prevailing time on Thursday, March 21, 2024, in the Conference Room, Middletown Thrall Library, 11-19 Depot Street, Middletown, New York.

A pre-bid meeting and walk-through is set for Thursday, March 7, 2024, at 10:00 A.M. on site, at which time the bidders can inspect the property and ask any questions. The meeting is not mandatory.

Complete digital sets of Bidding Documents, drawings and specifications, may be obtained online as a download at the following website: LAN.BIDDYHQ.COM under 'public projects'.

Complete sets of Bidding Documents, Drawings and Specifications, may be obtained from REVplans, 28 Church Street, Unit 7, Warwick, NY 10990, Tel: 845-651-3845, upon depositing the sum of $50 (Fifty Dollars) for each combined set of documents beginning on **Wednesday, February 28, 2024**. Checks or money orders shall be made payable to Thrall Library. Any bidder requiring documents to be shipped shall make arrangements with the printer and pay for all packaging and shipping costs.

Please note REVplans (revplans.biddyhq.com and lan.biddyhq.com) are the designated location and means for distributing and obtaining all bid package information. Only those Contract Documents obtained in this manner will enable a prospective bidder to be identified as an official plan holder of record. The Provider takes no responsibility for the completeness of Contract Documents obtained from other sources. Contract Documents obtained from other sources may not be accurate or may not contain addenda that may have been issued.

All bid addenda will be transmitted to registered plan holders via email and will be available at revplans.biddyhq.com and lan.biddyhq.com. Plan holders who have paid for hard copies of the bid documents will need to make the determination if hard copies of the addenda are required for their use and coordinate directly with the printer for hard copies of addenda to be issued. There will be no charge for registered plan holders to obtain hard copies of the bid addenda.

All technical questions regarding the bid should be directed to LAN Associates, EPAS, LLP (Attention Mr. Marco Menendez) by email to marco.menendez@lanassociates.com.

Bid security in the amount of 10% of the Bid must accompany each Bid in accordance with the INSTRUCTIONS TO BIDDERS.

A successful bidder is required to furnish and pay for a Performance Bond and a Payment Bond in amount equal to 100% of his Contract in accordance with the INSTRUCTIONS TO BIDDERS.

No Bidder may withdraw their Bid within 45 days after date of the opening of Bids. The Owner reserves the right to waive irregularities and to reject any and all Bids. The Owner reserves the right to award any part of this bid and reject the rest.

Contracts for work under this project will obligate the successful bidder and his subcontractors to observe all applicable federal, state and local laws and regulations in accordance with the INSTRUCTIONS TO BIDDERS.

Middletown Thrall Library is an equal opportunity affirmative action employer.

By: Matt Pfisterer
Middletown Thrall Library
Middletown, New York 10940

It is intended to receive bids for the HVAC Upgrades Middletown Thrall Library, 11-19 Depot Street, Middletown, New York 10940 (845) 341-5485 in accordance with the plans and specifications. The project will include all labor, material, and equipment. There will be one (1) contract: HVAC and associated work as per plans.

The bidders are hereby notified that this is a prevailing wage job and all Labor Department requirements are in full effect.

Middletown Thrall Library reserves the right to reject any and all bids not deemed to be in the best interest of Middletown Thrall Library. The prices submitted shall be exclusive of all Federal and State taxes.

Any award shall be subject to the issuance of a purchase order or execution of a contract between the Bidder and Middletown Thrall Library.

Middletown Thrall Library may, by written notice to vendor effective upon mailing, terminate this agreement in whole or in part at any time for,

1. Middletown Thrall Library convenience,
2. Upon the failure of the vendor to comply with any of the terms or conditions of this agreement, or
3. Upon vendor becoming insolvent or bankrupt.

All proposals shall be submitted complete with Notice to Bidders, Specifications and Information to Bidders, Proposal and Non-Collusive Bidding Certification pages. Each bid shall be properly executed and signed by the bidder. Unsigned bids will be rejected. Bids must be submitted to this office by the date and time indicated.

NO LATE BIDS WILL BE ACCEPTED - NO EXCEPTIONS.

Bidders must carry general liability insurance in the amount of $1,000,000.00 for any one person or property claim, and $3,000,000 for any one accident, and must be submitted by the successful bidder naming Middletown Thrall Library as additional insured.

Workers Compensation insurance certificate must be submitted by the successful bidder. All Labor Department regulations must be complied with for a prevailing wage job.

A bid bond of 10% of the price bid shall be submitted with the bid. The successful bidder shall provide a 100% performance bond and payment bond.

There shall be one (1) contract:

Contract #1 - Mechanical HVAC Upgrades and associated work

A pre-bid meeting and walk-through is set for Thursday, March 7, 2024 at 10:00 A.M. on site, at which time the bidders can inspect the property and ask any questions. The meeting is **not** mandatory.

Questions should be addressed to Marco Menendez, P.E., LAN Associates, Engineering, Planning, Architecture, Surveying, LLP, 252 Main Street, Goshen, New York; T# (845) 615-0350; Email marco.menendez@lanassociates.com.

Bidders may request RFI's from the Engineer up to 72 hours prior to be bid. RPI answers will be distributed to all bidders via fax.

The Contractor should acquaint himself with the Requirements of the New York State Department of Labor Industrial Code Rule No. 53, Dated April **1,** 1975. The number for the Underground Facilities Protective Organization is 1-800-962-7962.

As per New York State Labor Law amendment dated July 18, 2007, for all projects in excess of $250,000.00, all contractors and their laborers, workers, and mechanics must have completed the OSHA 10 hour Construction Outreach program.

The bids to include any and all labor and material required to complete the job, even if a specific item is inadvertently omitted. Plans or specifications may have one item not in both, if mentioned in either it is included.

Work to commence: September 1, 2024. Work must be completed by November 1, 2024 - NO EXCEPTIONS.

Bidders are directed to the Special Conditions section for important project information.

INSTRUCTIONS TO BIDDERS

AIA DOCUMENTS A 701

AIA® Document A701™ – 2018

Instructions to Bidders

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

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

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

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

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

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

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

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

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

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

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

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

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

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- **.5** the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- **.6** the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

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

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

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

§ 3.2 Modification or Interpretation of Bidding Documents

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

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

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

§ 3.3 Substitutions

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

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

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

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

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

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

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

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

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

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

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

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

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

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

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

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

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

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

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

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

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

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:
(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

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

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

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

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

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

§ 7.2 Time of Delivery and Form of Bonds
§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

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

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS
§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

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

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

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

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

CONTRACT #1 - MECHANICAL HVAC UPGRADES and ASSOCIATED WORK MIDDLETOWN THRALL LIBRARY

1.01 GENERAL

Pursuant to, and in compliance with, your Invitation to Bidders and the Information to Bidders relative thereto and all of the Contract Documents, including any Addenda issued by the Engineer and mailed to the undersigned prior to the opening of Bids, whether received by the undersigned or not, we hereby propose to furnish all labor, materials and equipment for HVAC Upgrades at Middletown Thrall Libra1y, 11-19 Depot Street Middletown, New York 10940 all to the satisfaction and approval of the Architect/Engineer and the Owner in accordance with the terms and conditions of the Contract Documents for Lump Sum of:

VENDOR: _____

ADDRESS: _____

_____

PHONE: _____ FAX: _____

BASE BID:

TOTAL LUMP SUM BID AMOUNT WRITTEN IN WORDS:

.....Dollars

and _____ Cents

TOTAL LUMP SUM BID AMOUNT IN FIGURES: $_____

1.02 TIME OF COMPLETION

A. It is agreed by the undersigned that after receipt of a Notice of Award and a consummation of a Contract Agreement in accord with the terms of the Contract Documents, he will start work within ten (10) consecutive calendar days of this notice to proceed and fully complete the work within sixty (60) days, schedule to be approved by engineer.

B. Liquidated Damages. Middletown Thrall Library and CONTRACTOR recognize that time is of the essence of this Agreement and that Middletown Thrall Library will suffer

financial loss if the Work is not completed within the time specified in Paragraph A above, plus any extensions thereof allowed in accordance with the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Middletown Thrall Library if the Work is not completed on time. Accordingly, instead of requiring any such proof, Middletown Thrall Library and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall apply Middletown Thrall Library Three Hundred Dollars ($300.00) for each day that expires after time specified in Paragraph 1.02A.

1.03 BID SECURITY

A. Attached hereto is a Bid Bond in the amount of ten percent (10%) of the Base Bid.

1.04 CHANGE ORDERS

A. We propose and agree that the above lump sum shall be adjusted for changes in the Contract Work not included in unit prices by addition of the following costs:
   1. Profit and overhead for all work performed by the Contractor - 15%; Subcontractors - 15%.
   2. Profit and overhead allowed to the Contractor and/or Subcontractors for work done by their Subcontractors - 7 %.

1.05 NON-COLLUSIVE BIDDING CERTIFICATION

A. Statement of Non-Collusion in Bids and Proposal to Political Subdivision of the State:

Every bid or proposal hereafter made to a political subdivision of the state or any public department, agency or official thereof where competitive bidding is required by statute, rule, regulation or local law, for work or services performed or to be performed or goods sold or to be sold, shall contain the following statement subscribed by the bidder and affirmed by such bidder as true under the penalties of perjury: Non-collusive bidding certification.

"(a) By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of knowledge and belief:

(1) The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;

(2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder

or to any competitor; and

(3) No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition. "

(b) A bid shall not be considered for award nor shall any award be made where (a)(l)(2) and (3) above have not complied with; provided however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the bid a signed statement which sets forth in detail the reasons therefor. Where (a)(1)(2) and (3) above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing using of the political subdivision, public department, agency or official thereof to which the bid is made, or his designee, determines that such disclosure was not made for the purpose of restricting competition.

The fact that a bidder (a) has published price lists, rates, or tariffs covering items being procured, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items, or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within the meaning of subparagraph one (a).

1) Any bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by a corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law, and where such bid contains the certification referred to in subdivision one of this section, shall be deemed to have been authorized by the board of directors of the bidder, and such authorization shall be deemed to include the signing and submission of the bid and the inclusion therein of the certificate as to non-collusion as the act and deed of the corporation.

Resolved that _____
(Name of Individual)
be authorized to sign and submit the bid or proposal of this corporation for the following project _____and to include in such bid or proposal the certificate as to non-collusion required by Section One Hundred Three (d) (103d) of the General Municipal Law as the act and deed of such corporation, and for any inaccuracies or mis-statements in such certificate this corporate bidder shall be liable under the penalties of perjury.

The foregoing is a true and correct copy of the resolution by

Corporation at a meeting of its Board of Directors held on the ____day of _____. 20__
SEAL OF THE CORPORATION)

_____
Secretary

1.06 ACCEPTANCE

A. When this Proposal is accepted, the undersigned agrees to enter into a Contract with the Owner as provided in the Form of Agreement.

1.07 AFFIRMS

A. The undersigned affirms and agrees that this Proposal is a firm one which remains in effect and will be irrevocable for a period of forty-five (45) days after opening of Bids.

1.08 TYPE OF BUSINESS

A. The undersigned hereby represents that it is a _____ (Corporation, Partnership, or an Individual). If a Corporation, then the undersigned further represents that it is duly qualified as a Corporation under the laws of New York State and it is authorized to do business in this State.

1.09 PLACE OF BUSINESS

A. The following is the name and address of the person to whom all notices required in connection with this Proposal may be telephoned, mailed or delivered.

Name _____

Address _____

Telephone .....

1.10 EXECUTION OF CONTRACT

A. When written Notice of Acceptance of the Proposal is mailed or delivered to the undersigned within forty-five (45) days after the opening of Bids, or anytime thereafter should the Proposal not be withdrawn, the undersigned, within ten (10) days, will execute the Form of Agreement with the Owner.

1.11 ADDENDA

A. Any addenda issued by the Architect and mailed or delivered to the undersigned prior to the Bid opening date shall become part of the Contract Documents. The Bidder shall enter on this list any addenda issued after this Form of Proposal has been received and shall fill in the addenda number and date.

Addendum#_____Dated: _____

Addendum#_____Dated: _____

Addendum#_____Dated: _____

Addendum#_____Dated: _____

Addendum#_____Dated: _____

Addendum#_____Dated: _____

Addendum# _____Dated: _____

1.12 ASBESTOS

A. The bidder certifies that no asbestos or asbestos-containing materials will be incorporated into the Work of this Contract.

Dated _____, 20___

Legal Name of Person
Partnership or Corporation

By _____

Title .....

Address .....

_____

_____

NOTE: The EQUALIZATION (SECTION 00400), INDEMNITY CLAUSE (SECTION 00410) and REFERENCE FORM (SECTION 00420) must be completely filled out and submitted as part of the FORM OF PROPOSAL.

SECTION 00301-1 STATEMENT OF NON-COLLUSION

MIDDLETOWN THRALL LIBRARY
11-19 DEPOT STREET
MIDDLETOWN, NEW YORK 10940

BY SUBMISSION OF THIS BID, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid, each party thereto, certifies as to its own organization under penalty of perjury that to the best of knowledge and belief:

(1) The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement for the purpose of restricting competition, as to any matter relating to such prices with any bidder, with any competitor;

(2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder, and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor;

(3) No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition;

(4) The person signing this bid certifies that he has fully informed himself regarding the accuracy of the statements contained in this certification, and under the penalties of perjury, affirms the truth thereof, such penalties being applicable to the bidder as well as to the person signing in its behalf;

(5) That attached hereto (if corporate bidder) is a certified copy of the resolution authorizing the execution of this certificate by the signator of this bid on behalf of the corporate bidder.

The foregoing statement has been read and subscribed by the undersigned bidder and is hereby affirmed as true under the penalties of perjury.

_____
(Signature)

_____
(Name/Title)

DATED: _____

EQUALIZATION:

Specifications for all items requested "or equal" are understood to apply where a brand name, trade name, catalog reference, or patented commodity is reference. References to such specific commodities are intended as descriptive and not restrictive. Comparable products will be considered if proof of comparability is provided, including appropriate catalog excerpts, descriptive literature, specifications and list data, etc. The purchasing agent's decision as to the acceptance of the product as equal will be final. Refer to item 3.3 of section 00120 "Modifications to Instructions to Bidders" for additional information.

_____
Officer of Company (Signature)

_____
Date

_____
Company Name

_____
Telephone

_____

_____

_____
Address

MIDDLETOWN THRALL LIBRARY
11-19 DEPOT STREET
MIDDLETOWN, NEW YORK 10940

INDEMNITY CLAUSE

The contractor shall indemnify and save harmless the owner against all claims on account of injury, loss or damage arising or alleged to arise out of or in connection with the performance of the work, including all expenses incurred by the owner in the defense, settlement or satisfaction thereof including expenses of attorney.

_____
Officer of Company (Signature)

_____
Date

_____
Company Name

_____
Telephone

_____

_____

_____
Address

HVAC UPGRADES AT
MIDDLETOWN THRALL LIBRARY
11-19 DEPOT STREET
MIDDLETOWN, NEW YORK 10940

REFERENCE FORM

All bidders will be required to complete this f01m providing three references of past performance. References should involve projects and/or service situations of similar size and scope to this bid. References must have had dealings with the Bidder within the last thirty-six (36) months. The Owner reserves the right to contact any or all of the references supplied for an evaluation of past performance in order to establish the responsibility of the Bidder before the actual award of the bid and/or contract. Completion of the reference form is required.

BIDDER'S NAME: _____

DATE FILED: _____

OFFICER'S NAME: _____

REFERENCE'S NAME: _____

ADDRESS: _____

TELEPHONE: _____

CONTACT PERSON _____

REFERENCE'S NAME: _____

ADDRESS: _____

TELEPHONE: _____

CONTACT PERSON _____

REFERENCE'S NAME: _____

ADDRESS: _____

TELEPHONE: _____

CONTACT PERSON _____

REFERENCE'S NAME: _____

ADDRESS: _____

TELEPHONE: _____

CONTACT PERSON _____

AIA® Document G702™ – 1992

Application and Certificate for Payment

TO OWNER:

PROJECT:

APPLICATION NO: 001
PERIOD TO:
CONTRACT FOR: General Construction
CONTRACT DATE:
PROJECT NOS: / /

Distribution to:
OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

FROM CONTRACTOR:

VIA ARCHITECT:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM		$0.00
2. NET CHANGE BY CHANGE ORDERS		$0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)		$0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)		$0.00
5. RETAINAGE:		
a. 0 % of Completed Work (Column D + E on G703)	$0.00	
b. 0 % of Stored Material (Column F on G703)	$0.00	
Total Retainage (Lines 5a + 5b or Total in Column I of G703)		$0.00
6. TOTAL EARNED LESS RETAINAGE (Line 4 Less Line 5 Total)		$0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)		$0.00
8. CURRENT PAYMENT DUE		$0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$0.00	

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$0.00	$0.00
Total approved this Month	$0.00	$0.00
TOTALS	$0.00	$0.00
NET CHANGES by Change Order		$0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED $0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

AIA® Document G703™ – 1992

Continuation Sheet

AIA Document, G702™–1992, Application and Certification for Payment, or G736™–2009, Project Application and Project Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.
In tabulations below, amounts are in US dollars.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:	001
APPLICATION DATE:	
PERIOD TO:	
ARCHITECT'S PROJECT NO:	

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED		MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D + E + F)	% (G ÷C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
			FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD					
	GRAND TOTAL								

AIA® Document G701™ – 2017

Change Order

PROJECT: *(Name and address)*

CONTRACT INFORMATION:
Contract For:
Date:

CHANGE ORDER INFORMATION:
Change Order Number:
Date:

OWNER: *(Name and address)*

ARCHITECT: *(Name and address)*

CONTRACTOR: *(Name and address)*

THE CONTRACT IS CHANGED AS FOLLOWS:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

The original Contract Sum was	$	0.00
The net change by previously authorized Change Orders	$	0.00
The Contract Sum prior to this Change Order was	$	0.00
The Contract Sum will be increased by this Change Order in the amount of	$	0.00
The new Contract Sum including this Change Order will be	$	0.00

The Contract Time will be increased by Zero (0) days.
The new date of Substantial Completion will be

NOTE: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ARCHITECT *(Firm name)*	CONTRACTOR *(Firm name)*	OWNER *(Firm name)*
SIGNATURE	SIGNATURE	SIGNATURE
PRINTED NAME AND TITLE	PRINTED NAME AND TITLE	PRINTED NAME AND TITLE
DATE	DATE	DATE

AIA® Document G704® – 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*	**CONTRACT INFORMATION:** Contract For: Date:	**CERTIFICATE INFORMATION:** Certificate Number: 001 Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.
(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE OF SUBSTANTIAL COMPLETION**

WARRANTIES
The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:
(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED
A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:
(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within ( ) days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: $

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:
(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE**
OWNER *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE**

AIA® Document G706A™ – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
		ARCHITECT: ☐
	CONTRACT FOR:	
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	CONTRACTOR: ☐
		SURETY: ☐
		OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY: _____

(Signature of authorized representative)

_____

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

AIA® Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
		ARCHITECT: ☐
	CONTRACT FOR:	CONTRACTOR: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	SURETY: ☐
		OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment ☐ Yes ☐ No

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR: *(Name and address)*

BY: _____
(Signature of authorized representative)

_____
(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

AIA® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)*	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
	CONTRACT FOR:	ARCHITECT: ☐
		CONTRACTOR: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	SURETY: ☐
		OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(*Insert name and address of Surety*)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

_____
(Surety)

_____
(Signature of authorized representative)

Attest:
(Seal):

_____
(Printed name and title)

AGREEMENT

THIS AGREEMENT, made this_____ day of_____, 20____, by and between MIDDLETOWN THRALL LIBRARY, 11-19 DEPOT STREET, MIDDLETOWN, NEW YORK, hereinafter called "OWNER" and _____, doing business as a corporation, hereinafter called "CONTRACTOR".

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The "PROJECT" means the Middletown Thrall Library HVAC Upgrades project described in the CONTRACT DOCUMENTS.
2. The "WORK" shall be in accord with and as required by the CONTRACT DOCUMENTS.
3. The CONTRACTOR will commence the WORK within **10** calendar days after the date of the NOTICE TO PROCEED and will complete the same within 60 calendar days unless the period for completion is extended in accord with the CONTRACT DOCUMENTS. CONTRACTOR further agrees to pay as liquidated damages, as provided in Section 15 of the General Conditions, the sum of $300.00 for each consecutive calendar day after the Scheduled Completion Date until the PROJECT is fully completed.
4. The CONTRACTOR agrees to perform all of the WORK and comply with the terms therein for the sum of $_____or as shown in the BID schedule.
5. The term "CONTRACT DOCUMENTS" means and includes the following:
   - (A) ADVERTISEMENT FOR BIDS
   - (B) INFORMATION FOR BIDDERS
   - (C) BID
   - (D) BID BOND
   - (E) NOTICE OF AWARD
   - (F) PAYMENT BOND
   - (G) PERFORMANCE BOND
   - (H) AGREEMENT
   - (I) NOTICE TO PROCEED
   - (J) APPLICATION FOR PAYMENT

(K) CHANGE ORDER

(L) GENERAL CONDITIONS

(M) MINORITY AND WOMENS BUSINESS ENTERPRISES

(N) SUPPLEMENTAL GENERAL CONDITIONS

(0) SPECIFICATIONS prepared or issued by LAN Associates, Engineering, Planning, Architecture, Surveying, LLP, dated _____.

(P) ADDENDA

No._____ dated_____

No._____ dated._____

No._____ dated_____

No._____ dated._____

No._____ dated_____

6. The OWNER will pay to the CONTRACTOR in the manner and at such times as set forth in the General Conditions such amounts as required by the CONTRACT DOCUMENTS.

7. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement in quadruplicate each of which shall be deemed an original on the date first above written.

OWNER: Middletown Thrall Library

11-19 Depot Street

Middletown, New York 10940

BY: _____

NAME: _____ (Please Type)

Title: _____ (SEAL)

ATTEST:

Name _____ (Please Type)

Title _____

CONTRACTOR: _____

_____

_____

BY: _____

NAME: _____(Please Type)

Title: _____(SEAL)

ATTEST:

Name _____ (Please Type)

Title _____

NOTICE OF AWARD

TO: _____

_____

_____

PROJECT DESCRIPTION:

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for Bids dated _____and Information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of $_____. You are required by the Information for Bidders to execute the Agreement and furnish the required CONTRACTOR'S PERFORMANCE BOND, PAYMENT BOND, and CERTIFICATE OF INSURANCE within ten (10) calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said BONDS within ten (10) days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER'S acceptance of your BID as abandoned and as forfeiture of your BID BOND. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

Dated this_____day of _____

MIDDLETOWN THRALL LIBRARY

By: _____

Title: _____

ACCEPTANCE OF NOTICE

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

Dated this_____ day of _____

_____(Contractor's Name)

By: _____

Title: _____

NOTICE TO PROCEED

TO: _____

_____

_____

PROJECT: _____

You are hereby notified to commence WORK in accordance with the Agreement dated _____ _____ on or before _____ and you are to complete the WORK within _____ consecutive calendar days thereafter. The date of completion of all WORK is therefore _____ _____.

MIDDLETOWN THRALL LIBRARY

OWNER

BY: _____

Title: _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____ this the _____ day of _____

_____ (Contractor's Name)

By: _____

Title: _____

PAYMENT BOND CONTRACT

KNOW ALL MEN BY THESE PRESENTS: that

_____(name of Contractor)

_____

_____, hereinafter called Principal,

_____(name of Surety)

_____

_____(address of Surety)

hereinafter called Surety, are held and firmly bound unto Middletown Thrall Library, (Owner)

11-19 Depot Street, Middletown, New York 10940 (address of Owner),

hereinafter called OWNER, in the penal sum of _____

_____ in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____day of _____,(the CONTRACT) a copy of which is hereto attached and made a part hereof for the construction of:

Middletown Thrall Library HVAC Upgrades

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, SUBCONTRACTORS, and corporations furnishing materials for or performing labor in the prosecution of the WORK provided for in such CONTRACT, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and all insurance premiums on said WORK, and for all labor, performed in such WORK whether by SUBCONTRACTOR or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the CONTRACT or to the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any wise affect its obligation on this BOND, and it done hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in 4 counterparts, one of which shall be deemed an original, this the _____day of _____.

ATTEST: _____
(Principal)

By _____(s)
(Principal)Secretary

(SEAL)

_____ _____
(Witness as to Principal) (Address)

_____ _____
(Address)

_____ _____
(Surety)

ATTEST:

_____
(Surety)Secretary

(SEAL)

_____ By_____
(Witness as to Surety) Attorney-in-Fact

_____ _____
(Address) (Address)

_____ _____

NOTE: If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the PROJECT is located.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

_____(name of Contractor)

_____

_____, hereinafter called Principal,

_____(.name of Surety)

_____

_____(address of Surety)

hereinafter called Surety, are held and firmly bound unto Middletown Thrall Library, (Owner)

11-19 Depot Street, Middletown, New York 10940 (address of Owner),

hereinafter called OWNER, in the penal sum of _____

_____ in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____day of _____,(the CONTRACT) a copy of which is hereto attached and made a part hereof for the construction of:

Middletown Thrall Library HVAC Upgrades

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said CONTRACT during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during the one year guarantee period, and if he shall satisfy all claims and demands incurred under such CONTRACT, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the CONTRACT or to the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any wise affect its obligation on this BOND, and it done hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in 4 counterparts, one of which shall be deemed an original, this the _____ day of _____.

ATTEST: _____
(Principal)

_____ By _____(s)
(Principal)Secretary

(SEAL)

_____ _____
(Witness as to Principal) (Address)

_____ _____
(Address)

_____ _____
(Surety)

ATTEST:

_____
(Surety)Secretary

(SEAL)

_____ By_____
(Witness as to Surety) Attorney-in-Fact

_____ _____
(Address) (Address)

_____ _____

NOTE: If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the PROJECT is located.

GENERAL CONDITIONS

1. Definitions
2. Additional Instructions & Detail Drawings
3. Schedules, Reports & Records
4. Drawings and Specifications
5. Shop Drawings
6. Materials, Services and Facilities
7. Inspection & Testing
8. Equivalents
9. Patents
10. Surveys, Permits, Regulations
11. Protection of Work, Property & Persons
12. Supervision by Contractor
13. Changes in the Work
14. Changes in the Contract Price or Time
15. Time for Completion & Liquidated Damages
16. Correction of Work
17. Subsurface Conditions
18. Suspension of Work, Termination & Delay
19. Payments to Contractor
20. Acceptance of Final Payment as Release
21. Insurance
22. Contract Security
23. Assignments
24. Indemnifications
25. Separate Contracts
26. Subcontracting
27. Engineer's Authority
28. Lands and Rights-of-Way
29. Guarantee
30. Taxes
31. Jurisdiction
32. Contract and Contract Documents
33. Acquisition of Plans and Specifications by Contractor
34. Quantities and Estimates
35. Contractor's Claim for Damage
36. Required Provisions Deemed Inserted
37. No Escalation Allowance for Labor or Material
38. Laws and Regulations
39. Sanitary Precautions
40. Extension of Time: No Waiver
41. Waiver
42. Legal Address of Contractor
43. Weather Conditions
44. Certificate of Completion
45. Right to Operate
46. Mutual Responsibility of Contractors
47. Responsibility for Work
48. Money to be Retained
49. Money for Repairs
50. Anti-Kickback Provisions and Wage Rates
51. Access to Work
52. Inspection
53. Requirements of NYS Department of Labor, Industrial Codes No. 23 and 53

1. DEFINITIONS

1.1 Whenever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

1.2 ADDENDA - Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the CONTRACT DOCUMENTS, DRAWINGS and SPECIFICATIONS, by additions, deletions, clarifications or corrections.

1.3 BID - The offer or proposal of the BIDDER submitted on the prescribed form setting forth the prices for the WORK to be performed.

1.4 BIDDER - Any person, firm or corporation submitting a BID for the WORK.

1.5 BONDS - The word BONDS shall mean the Bid, Performance, and Payment Bonds and other instruments of security furnished by the CONTRACTOR and his surety in accordance with the CONTRACT DOCUMENTS.

1.6 CHANGE ORDER - A written order to the CONTRACTOR authorizing an addition, deletion or revision in the WORK within the general scope of the CONTRACT DOCUMENTS, or authorizing an adjustment in the CONTRACT PRICE or CONTRACT TIME.

1.7 CONTRACT DOCUMENTS - The contract, including Advertisement for Bids, Information For Bidders, BID, Bid Bond, Agreement, Payment Bond, Performance Bond, NOTICE OF AWARD, NOTICE TO PROCEED, CHANGE ORDER, DRAWINGS, SPECIFICATIONS and ADDENDA.

1.8 CONTRACT PRICE - The total monies payable to the CONTRACTOR under the terms and conditions of the CONTRACT DOCUMENTS.

1.9 CONTRACT TIME - The number of calendar days stated in the CONTRACT DOCUMENTS for the completion of the WORK.

1.1 O CONTRACTOR - The person, firm or corporation with whom the OWNER has executed the Agreement.

1.11 DRAWINGS - The part of the CONTRACT DOCUMENTS which show the characteristics and scope of the WORK to be performed and which have been prepared or approved by the ENGINEER.

1.12 ENGINEER - The word ENGINEER shall mean LAN Associates, Engineering, Planning, Architecture, Surveying, LLP of Goshen, New York, or Engineer appointed by the OWNER in writing, acting either directly or through an authorized representative.

1.13 FIELD ORDER - A written order effecting a change in the WORK not involving an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, issued by the ENGINEER to the CONTRACTOR during construction.

1.14 NOTICE OF AWARD - The written notice of the acceptance of the BID from the OWNER to the successful BIDDER.

1.15 NOTICE TO PROCEED - Written communication issued by the OWNER to the CONTRACTOR authorizing him to proceed with the WORK and establishing the date of commencement of the WORK.

1.16 OWNER - The word OWNER shall mean Middletown Thrall Library.

1.17 PROJECT - The undertaking to be performed as provided in the CONTRACT DOCUMENTS.

1.18 RESIDENT PROJECT REPRESENTATIVE -The authorized representative of the OWNER who is assigned to the PROJECT site or any part thereof.

1.19 SHOP DRAWINGS - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the CONTRACTOR, a SUBCONTRACTOR, manufacturer, SUPPLIER or distributor, which illustrate how specific portions of the WORK shall be fabricated or installed.

1.20 SITE - The specific area adjacent to and the area upon which the WORK is being performed.

1.21 SPECIFICATIONS - A part of the CONTRACT DOCUMENTS consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

1.22 SUBCONTRACTOR - An individual, firm or corporation having a direct contract with the CONTRACTOR or with any other SUBCONTRACTOR for the performance of a part of the WORK at the site.

1.23 SUBSTANTIAL COMPLETION - The date as certified by the ENGINEER when the construction of the PROJECT or a specified part thereof is sufficiently completed, in accordance with the CONTRACT DOCUMENTS, so that the PROJECT or specified part can be utilized for the purposes for which it is intended.

1.24 SUPPLEMENTAL GENERAL CONDITIONS - Modifications to General Conditions required by a Federal agency for participation in the PROJECT and approved by the agency in writing

prior to inclusion in the CONTRACT DOCUMENTS, or such requirements that may be imposed by applicable state laws.

1.25 SUPPLIER - The word SUPPLIER shall me any person, material man or organization who supplies materials or equipment for the WORK, including that fabricated to a special design, but who does not perform labor at the site.

1.26 WORK - All labor necessary to produce the construction required by the CONTRACT DOCUMENTS, and all materials and equipment incorporated or to be incorporated in the PROJECT.

1.27 WRITTEN NOTICE - Any notice to any party to the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address or delivered in person to said party or his authorized representative on the WORK.

2. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

2.1 The CONTRACTOR may be furnished additional instructions and detail drawings, by the ENGINEER, as necessary to carry out the WORK required by the CONTRACT DOCUMENTS.

2.2 The additional drawings and instructions thus supplied will become a part of the CONTRACT DOCUMENTS. The CONTRACTOR shall carry out the WORK in accordance with the additional detail drawings and instructions.

3. SCHEDULES, REPORTS AND RECORDS

3.1 The CONTRACTOR shall submit to the OWNER such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data where applicable as are required by the CONTRACT DOCUMENTS for the WORK to be performed.

3.2 Prior to the first partial payment estimate the CONTRACTOR shall submit construction progress schedules showing the order in which he proposes to carry on the WORK, including dates at which he will start the various parts of the WORK, estimated date of completion of each part and, as applicable:

3.2.1 At least ten (10) days prior to preparation of the first estimate of payment, the CONTRACTOR shall provide a complete breakdown of the cost of lump sum items in the Bid in such a manner that the breakdown may be used as a basis for estimating the value of the work completed to the end of any month. The extent and basis of the breakdown shall meet the ENGINEER'S approval.

3.2.2 The dates at which special detail drawings will be required.

3.2.3 Respective dates for submission of SHOP DRAWINGS, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.

3.3 The CONTRACTOR shall also submit a schedule of payments that he anticipates he will earn during the course of the WORK.

4. DRAWINGS AND SPECIFICATIONS

4.1 The intent of the DRAWINGS and SPECIFICATIONS is that the CONTRACTOR shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the WORK in accordance with the CONTRACT DOCUMENTS and all incidental work necessary to complete the PROJECT in an acceptable manner, ready for use, occupancy or operation by the OWNER.

5. SHOP DRAWINGS

5.1 The CONTRACTOR shall provide SHOP DRAWINGS as may be necessary for the prosecution of the WORK as required by the CONTRACT DOCUMENTS. The ENGINEER shall promptly review all SHOP DRAWINGS. The ENGINEER'S approval of any SHOP DRAWING shall not release the CONTRACTOR from responsibility for deviations from the CONTRACT DOCUMENTS. The approval of any SHOP DRAWING which substantially deviates from the requirement of the CONTRACT DOCUMENTS shall be evidenced by a CHANGE ORDER.

5.1.1 After checking and verifying all field measurements, the CONTRACTOR will submit to the ENGINEER, in accordance with an agreed upon schedule of SHOP DRAWING submissions, six (6) copies of all SHOP DRAWINGS, which shall have been checked by and stamped with the approval of the CONTRACTOR and identified as the ENGINEER may require. The data shown on the SHOP DRAWINGS will be complete with respect to dimensions, design criteria, materials of construction and the like to enable the ENGINEER to review the information as required.

5.1.2 The CONTRACTOR will also submit to the ENGINEER for approval, with such promptness as to cause no delay in WORK, all samples required by the CONTRACT DOCUMENTS.

5.1.3 At the time of each submission, the CONTRACTOR will, in writing, call the ENGINEER'S attention to any deviations that the SHOP DRAWINGS or samples may have from the requirements of the CONTRACT DOCUMENTS.

5.2 When submitted for the ENGINEER'S review, SHOP DRAWINGS shall bear the CONTRACTOR'S certification that he has reviewed, checked and approved the SHOP DRAWINGS and that they are in conformance with the requirements of the CONTRACT DOCUMENTS.

5.2.1 The ENGINEER will review with reasonable promptness SHOP DRAWINGS and samples, but his review shall only be for conformance with the design concept of the PROJECT and for compliance with the information given in the CONTRACT DOCUMENTS. The Contractor will make any corrections required by the ENGINEER and will return the required number of corrected copies of SHOP DRAWINGS and resubmit new samples, if necessary. The CONTRACTOR shall direct specific attention, in writing or on resubmitted SHOP DRAWINGS, to revisions other than the corrections called for by the ENGINEER on previous submissions. The CONTRACTOR'S stamp of approval on any SHOP DRAWINGS or samples shall constitute a representation to the OWNER and the ENGINEER that the CONTRACTOR has determined and verified all quantities, dimensions, field construction criteria, materials, catalogs numbers and similar data, that he assumes full responsibility for doing so, and that he has reviewed or coordinated each SHOP DRAWING or sample with the requirements of the WORK and the CONTRACT DOCUMENTS.

5.3 Portions of the WORK requiring a SHOP DRAWING or sample submission shall not begin until the SHOP DRAWING or submission has been approved by the ENGINEER. A copy of each approved SHOP DRAWING and each approved sample shall be kept in good order by the CONTRACTOR at the site and shall be available to the ENGINEER.

6. MATERIALS, SERVICES AND FACILITIES

6.1 It is understood that, except as otherwise specifically stated in the CONTRACT DOCUMENTS, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the WORK within the specified time.

6.1.1 Any work necessary to be performed after regular working hours, on Sundays or on Legal Holidays, shall be performed without additional expense to the OWNER.

6.2 Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the WORK. Stored materials and equipment to be incorporated in the WORK shall be located so as to facilitate prompt inspection.

6.3 Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

6.4 Materials, supplies and equipment shall be in accordance with samples submitted by the CONTRACTOR and approved by the ENGINEER.

6.5 Materials, supplies or equipment to be incorporated into the WORK shall not be purchased by the CONTRACTOR or the SUBCONTRACTOR subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

6.5.1 Nothing in the CONTRACT shall be considered as vesting in the CONTRACTOR any right of property in materials used, after they shall have been attached or affixed to the WORK or the soil, nor in materials which have been accepted for partial payment at the SITE, but all such materials shall upon being so attached or affixed, or so accepted, become the property of the OWNER.

7. INSPECTION AND TESTING

7.1 All materials and equipment used in the construction of the PROJECT shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the CONTRACT DOCUMENTS.

7.2 The OWNER shall provide all inspection and testing services not required by the CONTRACT DOCUMENTS, except as otherwise specified.

7.3 The CONTRACTOR shall provide at his expense the testing and inspection services required by the CONTRACT DOCUMENTS.

7.4 If the CONTRACT DOCUMENTS, laws, ordinances, rules, regulations or order of any public authority having jurisdiction require any WORK to specifically be inspected, tested, or approved by someone other than the CONTRACTOR, the CONTRACTOR will give the ENGINEER timely notice of readiness. The CONTRACTOR will then furnish the ENGINEER the required certificates of inspection, testing or approval.

7.4.1 For pipe, cement, steel reinforcement, paint and similar materials which are normally tested in the shop by the manufacturer, the CONTRACTOR shall furnish the ENGINEER certified records of physical, chemical and other pertinent tests, and/or certified statements from the manufacturer that the materials have been manufactured and tested in conformity with the SPECIFICATIONS. Where such a small quantity of material is required as to make physical tests or chemical analyses impractical, a certificate from the manufacturer stating the results of such tests or analyses of similar materials which were concurrently produced may, at the

discretion of the ENGINEER, be considered as the basis for the acceptance of such materials.

7.4.2 Each manufacturer's certificate shall be endorsed or accompanied by the CONTRACTOR'S certificate that the material certified by the manufacturer will be the material incorporated in the WORK.

7.5 Inspections, tests or approvals by the ENGINEER or others shall not relieve the CONTRACTOR from his obligations to perform the WORK in accordance with the requirements of the CONTRACT DOCUMENTS.

7.6 The ENGINEER and his representatives will at all times have access to the WORK. In addition, authorized representatives and agents of any participating Federal or State agency shall be permitted to inspect all work, materials, payroll, records of personnel, invoices of materials, and other relevant data and records. The CONTRACTOR will provide proper facilities for such access and observation of the WORK and also for any inspection or testing thereof.

7.7 If any WORK is covered contrary to the written instructions of the ENGINEER it must, if requested by the ENGINEER, be uncovered for his observation and replaced at the CONTRACTOR'S expense.

7.8 If the ENGINEER considers it necessary or advisable that covered WORK be inspected or tested by others, the CONTRACTOR, at the ENGINEER's request, will uncover, expose or otherwise make available for observation, inspection or testing as the ENGINEER may require, that portion of the WORK in question, furnishing all necessary labor, materials, tools and equipment. If it is found that such WORK is defective, the CONTRACTOR will bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction. If, however, such WORK is not found to be defective, the CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate CHANGE ORDER shall be issued.

8. EQUIVALENTS

8.1 Whenever a material, article or piece of equipment is identified on the DRAWINGS or SPECIFICATIONS by reference in brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance of other salient requirements and that other products or equivalent capacities, quality and function shall be considered unless specifically stated otherwise in the SPECIFICATIONS. The CONTRACTOR may recommend the use of material, article, or piece of equipment of equivalent substance and function for those referred to in the CONTRACT DOCUMENTS by reference to brand name or catalogue number, and if, in the sole opinion of the ENGINEER, such material, article or piece of equipment is of equivalent substance and function to that specified, the ENGINEER may accept such proposed material, article or piece of equipment for the use by the CONTRACTOR. Such equivalent material, article or piece of equipment is not considered a substitution.

8.2 The CONTRACTOR warrants that if an equivalent material, article or piece of equipment is accepted, no major changes in the function or general design of the PROJECT will result. Incidental changes or extra component parts required to accommodate the equivalent material, article or piece of equipment will be made by the CONTRACTOR without a change in the CONTRACT PRICE or CONTRACT TIME.

9. PATENTS

9.1 The CONTRACTOR shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and save the OWNER harmless from loss on account thereof, except that the OWNER shall be responsible for any such loss when a particular process, design, or the product of a particular manufacturer or manufacturers is specified, however, if the CONTRACTOR has reason to believe that the design process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the ENGINEER.

10. SURVEY'S, PERMITS, REGULATIONS

10.1 The OWNER shall furnish to the CONTRACTOR all information that it has in its possession which the Engineer deems necessary for the CONTRACTOR to establish baselines and boundaries for the construction of this PROJECT. It shall be the duty of the CONTRACTOR to maintain his operations within the public way or to make such arrangements as he sees fit with adjoining property owners from the information provided by the OWNER, unless otherwise specified in the CONTRACT DOCUMENTS. Also, unless otherwise specified in the CONTRACT DOCUMENTS, the CONTRACTOR shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations and other working points, lines, elevations and cut sheets.

10.1.2 The ENGINEER may check the lines, elevations, reference marks, batter boards, etc. set up by the CONTRACTOR, and the CONTRACTOR shall correct any errors disclosed by such check. Such a check shall not be considered as approval of the CONTRACTOR'S work and shall not relieve the CONTRACTOR of the responsibility for accurate construction of the entire WORK. The CONTRACTOR, at CONTRACTOR'S expense, shall furnish the services of a man to help the ENGINEER in checking lines and grades.

10.2 The CONTRACTOR shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

10.3 Permits and licenses of a temporary nature necessary for the prosecution of the WORK shall be secured and paid for by the CONTRACTOR unless otherwise stated in the SUPPLEMENTAL GENERAL CONDITIONS. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the OWNER, unless otherwise specified. The CONTRACTOR shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the WORK as drawn and specified. If the CONTRACTOR observes that the CONTRACT DOCUMENTS are at variance therewith, he shall promptly notify the ENGINEER in writing, and any necessary changes shall be adjusted as provided in Section 13, CHANGES IN THE **WORK.**

10.4 All work in, upon, under or across public highways not under the control of the OWNER, shall be in accordance with permission to be granted by the Town, State of New York or other jurisdictions, pursuant to the provisions of the Highway Law relating thereto. The CONTRACTOR shall conform to all requirements in the permit, if any, to be issued by the appropriate Highway officials. If such a permit is to be issued then, before work starts, the CONTRACTOR shall hold a preconstruction conference with the officials issuing the permit.

11. PROTECTION OF WORK, PROPERTY AND PERSONS

11.1 The CONTRACTOR will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the WORK. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage,

injury or loss to all employees on the WORK and other persons who may be affected thereby. All the WORK and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

11.1.1 Work conducted on this PROJECT shall be in compliance with all federal, state and local safety and health laws and regulations applicable to the PROJECT and the WORK, including, without limitation, the Rules and Regulations of the Occupational Safety and Health Administration (OSHA) {the foregoing collectively referred to as the "Regulations"). CONTRACTOR represents that it is familiar with requirements of the Regulations.

11.1.2 The CONTRACTOR will indemnify, defend and save harmless the ENGINEER and the OWNER from any suits, claims, actions, fines, penalties and expenses, including reasonable attorney's fees, resulting from violations of any Regulations by the CONTRACTOR, any SUBCONTRACTOR and their respective employees relating to the PROJECT for the WORK and this provision shall survive termination of the CONTRACT DOCUMENTS.

11.1.3 The CONTRACTOR shall maintain an accurate record of all cases of death, occupational disease and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the Contract Documents.

11.2. The CONTRACTOR will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. He will erect and maintain, as required by the conditions and progress of the WORK, all necessary safeguards for safety and protection. He will notify owners of adjacent utilities when prosecution of the WORK may affect them. The CONTRACTOR will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the CONTRACTOR, any SUBCONTRACTOR or anyone directly or indirectly employed by any of them or anyone for whose acts any of them be liable, except damage or loss attributable to the fault of the CONTRACT DOCUMENTS or to the wrongful or negligent acts or omissions of the OWNER or the ENGINEER or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the CONTRACTOR

11.2.1 If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect or misconduct on the part of the CONTRACTOR or any SUBCONTRACTOR relating in any way to the WORK or the PROJECT, such property shall be restored by the CONTRACTOR, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the ENGINEER. No representations are made by the OWNER or ENGINEER concerning the condition, location or state of repair of existing sewers, drains, water mains and other underground structures.

11.2.2 The CONTRACTOR shall assume full responsibility for the following:

(a) To store his apparatus, materials, supplies and equipment in such orderly fashion at the SITE as will not unduly interfere with the progress of his work or the work of any other contractor;

(b) To provide suitable storage facilities for all materials which are liable to injury by exposure to weather, theft, breakage or otherwise;

(c) To place upon the WORK or any part thereof only such loads as are consistent with the safety of that portion of the WORK;

(d) To clean up frequently all refuse, rubbish, scrap materials and debris caused by his operations, to the end that at all times the SITE shall present a neat, orderly and workmanlike appearance;

(e) To remove all surplus material, false-work, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the SITE in a neat, orderly condition before final payment; and

(f) To affect all cutting, fitting or patching of his WORK required to make the same to conform to the PLANS and SPECIFICATIONS and, except with the consent of the OWNER, not to cut or otherwise alter the WORK of any other CONTRACTOR.

11.3 In emergencies affecting the safety of persons or the WORK or property at the site or adjacent thereto, the CONTRACTOR, without special instruction or authorization from the ENGINEER or OWNER, shall act to prevent threatened damage, injury or loss. He will give the ENGINEER prompt WRITTEN NOTICE of any significant changes in the WORK or deviation from the CONTRACT DOCUMENTS caused thereby, and a CHANGE ORDER shall thereupon be issued covering the changes and deviations involved.

11.4 The CONTRACTOR shall not, except after written consent from proper parties, enter or occupy with men, tools, materials or equipment any privately owned land, except pursuant to easements, if any, provided herein.

11.5 The CONTRACTOR shall exercise proper precaution at all times for the protection of persons and property and shall be responsible for all damages to persons or property, either on or off the SITE, which occur as a result of his prosecution of the WORK. The safety provisions of applicable laws and building and construction codes, in addition to specific safety and health regulations described by Chapter XIII, Bureau of Labor Standards, Department of Labor, Part 1518, Safety and Health Regulations for Construction, as outlined in the Federal Register, Volume 36, No. 75, Saturday, April 17, 1971, Title 29 - LABOR, shall be observed and the CONTRACTOR shall take or cause to be taken such additional safety and health measures as the OWNER may determine to be reasonably necessary.

11.6 Special conditions pertaining to hazards, safety standards and accident prevention.

11.6.1 When the use of explosives is necessary for the execution of the WORK, the CONTRACTOR shall observe all local, state and federal laws in purchasing and handling explosives. The CONTRACTOR shall take all necessary precaution to protect completed work, neighboring property, water lines or other underground structures. Where there is danger to structures or property from blasting, the charges shall be reduced and the material shall be covered with suitable timber, steel or rope mats.

The CONTRACTOR shall notify all owners of public utility property of intention to use explosives at least eight (8) hours before blasting is done close to such property. Any supervision or direction of use of explosives by the ENGINEER does not in any way reduce the responsibility of the CONTRACTOR or his Surety for damages that may be caused by such use.

11.6.2 The CONTRACTOR shall make all necessary precautions to guard against damages to property and injury to persons. He shall put up and maintain in good condition sufficient red or warning lights at night, suitable barricades and other devices necessary to protect the public. In case the CONTRACTOR fails or neglects to take such precautions, the OWNER may have such lights and barricades installed and charge the cost of this work to the CONTRACTOR. Such action by the OWNER

does not relieve the CONTRACTOR of any liability incurred under these SPECIFICATIONS or CONTRACT.

12. SUPERVISION BYCONTRACTOR

12.1 The CONTRACTOR will supervise and direct the WORK. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The CONTRACTOR will employ and maintain on the WORK a qualified supervisor or superintendent who shall have been designated in writing by the CONTRACTOR as the CONTRACTOR'S representative at the site. The supervisor shall have full authority to act on behalf of the CONTRACTOR and all communications given to the supervisor shall be as binding as if given to the CONTRACTOR. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the WORK.

13. CHANGES IN THE WORK

13.1 The OWNER may at any time, without invalidating the AGREEMENT, make changes in the detail of the WORK. The CONTRACTOR shall proceed with the performance of any changes in the WORK so ordered. If the CONTRACTOR believes such order entitles him to a change in the CONTRACT PRICE or TIME, he shall immediately give the ENGINEER written notice thereof prior to commencing the WORK. Thereafter, the CONTRACTOR shall document the basis for the change in CONTRACT PRICE or TIME by keeping a AForce Account@ on a daily basis of the cost of said WORK and furnish the ENGINEER with a copy thereof daily. The CONTRACTOR understands and agrees that should his opinion with respect to said work differ from that of the ENGINEER he will proceed with the WORK and not delay the project. If the OWNER determines that said WORK is extra WORK, then a CHANGE ORDER would be entered into in accordance with Paragraph 14 below. If the OWNER determines that said WORK is CONTRACT WORK, then the CONTRACTOR shall, upon the completion of the WORK, and the appropriate notices given, as above indicated, be entitled to preserve a claim against the OWNER for said WORK, providing the claim is filed pursuant to the provisions of this AGREEMENT.

13.2 The ENGINEER, also, may at any time, by issuing a FIELD ORDER, make changes in the details of the WORK. The CONTRACTOR shall proceed with the performance of any changes in the WORK so ordered by the ENGINEER unless the CONTRACTOR believes that such FILED ORDER entitles him to a change in the CONTRACT PRICE or TIME, or both, in which event he shall give the ENGINEER WRITTEN NOTICE thereof within seven (7) days after the receipt of the ordered change. Thereafter the CONTRACTOR shall document the basis for the change in CONTRACT PRICE or TIME, or both, within thirty (30) days. The CONTRACTOR shall not execute such changes pending receipt of an executed CHANGE ORDER or further inspection from the OWNER.

14. CHANGES IN CONTRACT PRICE OR TIME

14.1 The CONTRACT PRICE or TIME may be changed only by a CHANGE ORDER. When negotiations are required, they shall be conducted in accordance with paragraph 14.2 or 14.3 below, as appropriate. The Value of any WORK covered by a CHANGE ORDER or of any claim for increase or decrease in the CONTRACT PRICE shall be determined by the method set forth in paragraphs 14.1.1 through 14.1.3 of this paragraph, whichever is most advantageous to the OWNER.

14.1.1 Unit prices.

14.1.1.1 Original BID items. Unit prices previously approved are acceptable for pricing changes of original BID items. However, when changes in quantities exceed 20 percent of the original BID quantity and the total dollar change of that BID item is significant, the unit price shall be reviewed by the OWNER to determine if a new unit price should be negotiated.

14.1.1.2 New Items. Unit prices of new items shall be negotiated.

14.1.2 A lump sum to be negotiated.

14.1.3 Cost reimbursement - The actual cost for labor, direct overhead, materials, supplies, equipment, and other services necessary to compete the Work by keeping a AForce Account@, plus an amount to be agreed upon to cover the cost of general overhead and profit, but not to exceed the following percentages:

1. CONTRACTOR'S overhead percentage, 5%

2. CONTRACTOR'S profit percentage, 5%

3. If WORK is done by a subcontractor
   - SUBCONTRACTOR'S overhead percentage, 5%
   - SUBCONTRACTOR'S profit percentage, 5%
   - CONTRACTOR'S combined overhead and profit percentage, 5%

4. Overhead and profit may not be applied to payroll taxes and insurance;

5. If the CHANGE ORDER results in deletion of Work then the value of such deletion should be subtracted from the total in order to arrive at an equitable change in the CONTRACT PRICE.

14.2 For each CHANGE ORDER the CONTRACTOR shall submit to the OWNER for review sufficient cost and pricing data as described in paragraphs 14.2.1 through 14.2.3 below to enable the OWNER to ascertain the necessity and reasonableness of costs and amounts proposed.

14.2.1 As a minimum, proposed CHANGE ORDER costs shall be presented in the summary format prescribed and shall be supported by a certification executed by the CONTRACTOR that proposed costs reflect complete current and accurate cost and pricing data applicable to the date of the CHANGE ORDER.

14.2.2 In addition to the specific elements of cost, the estimated amount of profit shall be set forth separately in the cost summary for fixed price. CHANGE ORDERS and a specific total dollar amount of profit will be set forth separately in the cost summary for cost reimbursement CHANGE ORDERS.

14.2.3 More detailed cost data than that required by the summary format may be required by the OWNER to substantiate the reasonableness of proposed CHANGE ORDER costs. Such detailed documentation is normally required by the OWNER only when the CONTRACTOR is unable to certify the proposed CHANGE ORDER costs are complete, current and accurate.

14.3 See also Section 01153 for CHANGE ORDER procedures.

15. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

15.1 The date of beginning and the time for completion of the WORK are essential conditions of the CONTRACT DOCUMENTS and the WORK embraced shall be commenced on a date specified in the NOTICE TO PROCEED.

15.2 The CONTRACTOR will proceed with the WORK at such rate of progress to insure full completion within the CONTRACT TIME. It is expressly understood and agreed, by and between the CONTRACTOR and the OWNER, that the CONTRACT TIME for the completion of the WORK described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the WORK.

15.3 If the CONTRACTOR shall fail to complete all WORK within the CONTRACT TIME, or extension of time granted by the OWNER, then the CONTRACTOR will pay the OWNER the amount for liquidated damages as specified in the BID for each calendar day that the CONTRACTOR shall be in default after the time stipulated in the CONTRACT DOCUMENTS. Said amount is hereby agreed upon and is fixed and determined by the parties hereto as the actual damages that the OWNER will suffer by reason of said delay and not as penalty. OWNER may deduct the amount of such liquidated damages out of monies which may be due or become due from periodic estimates. In addition, the OWNER may deduct from estimates or charge the CONTRACTOR for any engineering and inspection services incurred during said period of delay.

15.4 The CONTRACTOR shall not be charged with liquidated damages of any excess cost when the delay in completion of the WORK is due to the following, and the CONTRACTOR has promptly given WRITTEN NOTICE of such delay to the OWNER or ENGINEER:

15.4.1 To any preference, priority or allocation order duly issued by the OWNER;

15.4.2 To unforeseeable causes beyond the control and without the fault or negligence of the CONTRACTOR, including but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and abnormal and unforeseeable weather; and

15.4.3 Delays which affect the scheduled completion of the WORK and are attributed to interference between CONTRACTORS or CONTRACTORS and utility owners, shall be compensated solely by granting of an extension of time by the OWNER to complete the WORK without engineering charges. The time necessary for review of SHOP DRAWING and delays incurred by seasonal limitations should be anticipated and are not compensatory. The CONTRACTOR agrees that he had included in his Bid the additional cost of doing WORK under this CONTRACT caused by interference of other CONTRACTORS and utilities and the other non-compensatory delays described above.

16. CORRECTION OF WORK

16.1 The CONTRACTOR shall promptly remove from the premises all WORK rejected by the ENGINEER for failure to comply with the CONTRACT DOCUMENTS, whether incorporated in the construction or not, and the CONTRACTOR shall promptly replace and re-execute the WORK in accordance with the CONTRACT DOCUMENTS and without expense to the OWNER and shall bear the expense of making good all WORK of other CONTRACTORS destroyed or damaged by such removal or replacement.

16.2 All removal and replacement WORK shall be done at the CONTRACTOR'S expense. If the CONTRACTOR does not take action to remove such rejected WORK within ten (10) days after receipt of WRITTEN NOTICE, the OWNER may remove such WORK and store the materials at the expense of the CONTRACTOR.

16.3 Neither the foregoing nor any provisions of these CONTRACT DOCUMENTS, nor any special guarantee time limit shall be held to limit the CONTRACTOR'S liability for defects to less than the legal limit of liability in accordance with the law of the place of construction.

17. SUBSURFACE CONDITIONS

17.1 The CONTRACTOR shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the OWNER by WRITTEN NOTICE of:

17.1.1 Subsurface or latent physical conditions at the site differing materially from those indicated in the CONTRACT DOCUMENTS; or

17.1.2 Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in WORK of the character provided for in the CONTRACT DOCUMENTS.

17.2 The OWNER shall promptly investigate the conditions, and if he finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the WORK, an equitable adjustment shall be made and the CONTRACT DOCUMENTS shall be modified by a CHANGE ORDER. Any claim of the CONTRACTOR for adjustment hereunder shall not be allowed unless he has given the required WRITTEN NOTICE; provided that the OWNER may, if he determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

17.3 Information on the DRAWINGS and all statements in the CONTRACT DOCUMENTS referring to the condition under which the WORK is to be performed or the existence of utilities or other underground structures are not guaranteed to be correct or to be a complete representation of all existing data with reference to conditions affecting the WORK. Reasonable efforts have been made, however, to make this information complete and accurate on the basis of all data and information which could be procured by the ENGINEER. The CONTRACTOR shall make his own examination and shall draw his own conclusions as to the underground facilities or conditions which will be encountered and he shall have no claim for damages or increase in the CONTRACT PRICE of any kind on account of errors, inaccuracies or omission that may be found. Protection and temporary removal and replacement of existing utilities and structures shall be part of this CONTRACT and all costs in connections therewith shall be included in the prices established in the Proposal.

17.4 If the OWNER shall determine that such conditions do not warrant of cause an increase or decrease in the cost of, or in the time required for, the performance of the WORK then the CONTRACTOR shall proceed to perform the WORK and keep a daily account of the cost thereof and furnish the same to the OWNER on a daily basis. The Force Account shall be kept pursuant to the formula in Paragraph 14 above, as a condition precedent to the filing of a claim and further, providing appropriate notice is given.

18. SUSPENSION OF WORK, TERMINATION AND DELAY

18.1 If the CONTRACTOR is adjudged a bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for the CONTRACTOR or for any of his property, or if he files a petition to take advantage of any debtor's at, or to reorganize under the bankruptcy or applicable laws, or if he repeatedly fails to supply sufficient skilled workman or suitable materials or equipment, or if he repeatedly fails to make prompt payments to SUBCONTRACTORS or for labor, materials or equipment or if he disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the WORK or if he disregards the authority of the ENGINEER, or if he otherwise violates any provision of the CONTRACT DOCUMENTS, then the OWNER may, without prejudice to any other right or remedy and after giving the CONTRACTOR and his

surety a minimum of ten (10) days from delivery of a WRITTEN NOTICE, terminate the services of the CONTRACTOR and take possession of the PROJECT and of all materials, equipment, tools, construction equipment and machinery thereon owned by the CONTRACTOR, and finish the WORK by whatever method he may deem expedient. In such case the CONTRACTOR shall not be entitled to receive any further payment until the WORK is finished. If the unpaid balance of the CONTRACT PRICE exceeds the direct and indirect costs of completing the PROJECT, including compensation for additional professional services, such excess SHALL BE PAID TO THE CONTRACTOR. IF such costs exceed such unpaid balance, the CONTRACTOR will pay the difference to the Owner.

18.2 Where the CONTRACTOR'S services have been so terminated by the OWNER, said termination shall not affect any right of the OWNER against the CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of monies by the OWNER due the CONTRACTOR will not release the CONTRACTOR from compliance with the CONTRACT DOCUMENTS.

18.3 After ten (10) days from delivery of a WRITTEN NOTICE to the CONTRACTOR and the ENGINEER, the OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the PROJECT and terminate the CONTRACT. In such case, the CONTRACTOR shall be paid for all WORK executed and any expense sustained plus reasonable profit.

19. PAYMENTS TO CONTRACTOR

19.1 At least ten (10) days before each progress payment falls due (but not more often than once a month), the CONTRACTOR will submit to the ENGINEER a partial payment estimate filled out and signed by the CONTRACTOR covering the WORK performed during the period covered by the partial payment estimate and supported by such data as the ENGINEER may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the WORK, but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the OWNER, as will establish the OWNER'S title to the material and equipment and protect his interest therein, including applicable insurance. The ENGINEER will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present the partial payment estimate to the OWNER, or return the partial payment estimate to the CONTRACTOR indicating in writing his reasons for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the partial payment estimate. The OWNER will, within thirty (30) days of presentation to him of an approved partial payment estimate, pay the CONTRACTOR a progress payment on the basis of the approved partial payment estimate.

19.1.1 The CONTRACTOR shall prepare his monthly request for payment on a schedule such that the ENGINEER will receive it (5) working days before the first Monday of the next month.

19.1.2 The OWNER shall retain five (5%) percent of the amount of each payment until final completion and acceptance of all WORK covered by the CONTRACT DOCUMENTS in addition to an amount necessary to satisfy any claims, liens or judgments against the CONTRACTOR which have not been suitably discharged.

19.1.3 In accordance with Labor Law Section 220-a-(2), CONTRACTOR'S request for partial payment shall include his affidavit which indicates the amounts then due and owing to laborers and the names of those who are unpaid.

19.2 If the request for payment also includes an allowance for the cost of such major materials and equipment which are suitably stored either at or near the site, an allowance of seventy-five percent (75%) of the material or equipment cost, supported by a copy of the invoice from

the manufacturer to the CONTRACTOR, will be included in the CONTRACTOR request for payment.

19.2.1 Each request for payment shall include an affidavit by the CONTRACTOR stating that title to all work, materials and equipment is free of all liens, claims, security interests or other encumbrances.

19.2.2 The type of equipment and material eligible for payment prior to being incorporated in the WORK will be at the ENGINEER'S discretion. In general, larger items of material and equipment, material and equipment made specifically for the subject job, and material and equipment requiring extensive time to be manufactured or obtained will be eligible for payment. Items, such as copper tubing or soil pipe, and items which are readily available for purchase will not be considered eligible.

19.3 Prior to SUBSTANTIAL COMPLETION, the OWNER, with the approval of the ENGINEER and with the concurrence of the CONTRACTOR, may use any completed or substantially completed portions of the WORK. Such use shall not constitute an acceptance of such portions of the WORK.

19.4 The OWNER shall have the right to enter the premises for the purpose of doing WORK not covered by the CONTRACT DOCUMENTS. This provision shall not be construed as relieving the CONTRACTOR of the sole responsibility for the care and protection of the WORK, or the restoration of any damaged WORK except such as may be caused by agents or employees of the OWNER.

19.5 Upon Completion of the WORK, the CONTRACTOR shall submit a final payment request. Upon acceptance of the WORK by the ENGINEER, the ENGINEER shall issue a final certificate attached to the final payment request that the WORK has been accepted by him under the conditions of the CONTRACT DOCUMENTS. The entire balance found to be due the CONTRACTOR, including the retained percentages, but except such sums as may be lawfully retained by the OWNER, shall be paid to the CONTRACTOR within thirty (30) days of completion and acceptance of the WORK. The date of the final certificate, if accepted by the OWNER, shall be the date of Final Completion.

19.5.1 Upon SUBSTANTIAL COMPLETION of the WORK or major portions thereof as contemplated by the terms of the CONTRACT DOCUMENTS, the CONTRACTOR shall submit a final payment request to the OWNER for the remaining amount of the CONTRACT balance. Simultaneously, the CONTRACTOR shall submit to the OWNER a Maintenance Bond in accordance with Paragraph 49 of these Conditions. Upon receipt of request after such SUBSTANTIAL COMPLETION the OWNER shall pay the remaining amount of the CONTRACT balance less two times (2X) the value of any remaining items to be completed and an amount necessary to satisfy any claims, liens or judgments against the CONTRACTOR which have not be suitable discharged. As the remaining items of work are satisfactorily completed or corrected, the OWNER shall promptly pay, upon receipt of a requisition, for these items less an amount necessary to satisfy any claims, liens or judgments against the CONTRACTOR which have not been suitably discharged.

19.5.2 The CONTRACTOR shall submit to the OWNER executed originals of "Contractor's Affidavit for Release of Retainage and/or Final Payment" and "Consent of Surety Company to Final Payment" with the final payment request.

19.6 The CONTRACTOR will indemnify and save the OWNER or the OWNER'S agents harmless from all suits, claims, liabilities and expenses including reasonable attorney's fees, growing out of the demands of SUBCONTRACTORS, laborers, workmen, mechanics, material men, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the WORK. The CONTRACTOR shall, at the OWNER'S request, furnish satisfactory evidence that all obligations of the nature designated

above have been paid, discharged, or waived. If the CONTRACTOR fails to do so the OWNER may, after having notified the CONTRACTOR, either pay unpaid bills or withhold from the CONTRACTOR'S unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the CONTRACTOR shall be resumed, in accordance with the terms of the CONTRACT DOCUMENTS, but in no event shall the provisions of this sentence be construed to impose any obligations upon the OWNER to either the CONTRACTOR, his Surety, or any third party. In paying any unpaid bills of the CONTRACTOR, any payment so made by the OWNER shall be considered as a payment made under the CONTRACT DOCUMENTS by the OWNER to the CONTRACTOR and the OWNER shall not be liable to the CONTRACTOR for any such payments made in good faith.

19.6.1 In accordance with Section 106-b of the General Municipal Law of the State of New York as amended March 16, 1978, the CONTRACTOR shall, within fifteen (15) calendar days of the receipt of any payment from the OWNER, pay each of his SUBCONTRACTORS and material men the proceeds from the payment representing the value of the work performed and/or materials furnished by the SUBCONTRACTOR and/or material men as reflected in the payment from the OWNER less an amount necessary to satisfy any claims, liens or judgments against the SUBCONTRACTOR or material men which have not been suitably discharged and less any retained amount as hereinafter described. The CONTRACTOR shall retain not more than five percent (5%) of each payment to the SUBCONTRACTOR and/or material men except that the CONTRACTOR may retain in excess of five percent (5%) but not more than ten percent (10%) to the SUBCONTRACTOR provided that prior to entering into a subcontract with the CONTRACTOR, the SUBCONTRACTOR is unable or unwilling to provide a performance bond and a payment bond both in the full amount of the subcontract at the request of the CONTRACTOR. However, the CONTRACTOR shall retain nothing from those payments representing proceeds owed the SUBCONTRACTOR and/or material men from the OWNER'S payments to the CONTRACTOR for the remaining amounts of the CONTRACT balance as provided in 19.1.2 and 19.5.1. Within fifteen (15) calendar days of the receipt of payment from the CONTRACTOR, the SUBCONTRACTOR and/or material men shall pay each of his SUBCONTRACTORS and material men in the same manner as the CONTRACTOR has paid the SUBCONTRACTOR and the CONTRACTOR'S agreement with each SUBCONTRACTOR will provide for such payments. Nothing provided herein shall create any obligation on the part of the OWNER to pay or to see to the payment of any monies to any SUBCONTRACTOR or material men from any CONTRACTOR nor shall anything provided herein serve to create any relationship in CONTRACT or otherwise, implied or expressed between SUBCONTRACTOR or material men and **the OWNER.**

19.7 No interest shall be allowed the CONTRACTOR on retained percentages.

20. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

20.1 The acceptance by the CONTRACTOR or by anyone claiming by or through him of the final payment shall constitute and operate as a release to the OWNER for any and all claims of any liability to the CONTRACTOR for anything theretofore done or furnished for or relating to or arising out of WORK done thereto and for any price, act, neglect or default on the part of the OWNER or any of its officers, agents or employees unless the CONTRACTOR serves a detailed verified statement of claim upon the OWNER prior to the submission of the final estimate. Such statement shall specify the items and details upon which the claim will be based and any such claim shall be limited to such items. The CONTRACTOR further understands and agrees that any action to recover for any claims resulting from the CONTRACT herein shall be commenced within six (6) months from the date of substantial completion, and will be limited only to those claims detailed on the statement of claim. No

payment, however, final or otherwise shall operate to release the CONTRACTOR or his sureties from any obligation under this CONTRACT or the PERFORMANCE BOND.

21. INSURANCE

21.1 The CONTRACTOR shall purchase and maintain such insurance as will protect him from claims set forth below which may arise out of or result from the CONTRACTOR'S execution of the WORK, whether such execution be by himself or by any SUBCONTRACTOR or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

21.1.1 Claims under written workmen's compensation, disability benefit and other similar employee benefit acts;

21.1.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of his employees;

21.1.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;

21.1.4 Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the CONTRACTOR, or (2) by any other person; and

21.1.5 Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

21.1.6 Contractor's Liability Insurance and Worker's Compensation shall comply with the State of New York statutory limits.

21.2 Before the CONTRACTOR commences work, the insurance company will provide the OWNER and ENGINEER an INSURANCE ENDORSEMENT CERTIFICATE indicating that the required insurance is in force; that the OWNER and ENGINEER are listed as additional insured; and stating that the policies will not be materially changed, become nonrenewable or canceled without thirty (30) days advance notice by registered mail return receipt requested to the OWNER (Middletown Thrall Library) and LAN Associates, Engineering, Planning, Architecture, Surveying, LLP, 252 Mainfmiddle Street, Goshen, NY 10924. The representative signing the certificate shall furnish evidence that he is authorized to so sign as well as his address and the name of the agency or agencies through which the insurance was obtained.

21.3 The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, liability insurance as hereinafter specified:

21.3.1 Minimum limits of liability of General Public Liability and Property Damage Insurance including vehicle coverage:

		Each Occurrence	For any One Occurrence
(a)	Bodily injury, including death, at any time resulting there from sustained by any one person	$3,000,000	
(b)	Such damage (as in (a)) sustained by two or more persons		$3,000,000

(c)	Property damage sustained by any one person	$1,000,000	
(d)	Such damage (as in (c)) sustained by two or more persons		$1,000,000

The Middletown Thrall Library and LAN Associates, Engineering, Planning, Architecture, Surveying, LLP to be named insured.

21.3.2 The CONTRACTOR shall acquire and maintain, if applicable, Fire and Extended Coverage insurance upon the PROJECT to the full insurable value thereof for the benefit of the OWNER, the CONTRACTOR, and SUBCONTRACTORS as their interest may appear. This provision shall in no way release the CONTRACTOR or CONTRACTOR'S surety from obligations under the CONTRACT DOCUMENTS to fully complete the PROJECT.

21.4 The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, in accordance with the provision of the laws of the state in which the WORK is performed. Workmen's Compensation Insurance, including occupational disease provisions, for all of his employees at the site of the PROJECT and in case any WORK is sublet, the CONTRACTOR shall require such SUBCONTRACTOR similarly to provide Workmen's Compensation Insurance, including occupational disease provisions for all of the latter's employees unless such employees are covered by the protection afforded by the CONTRACTOR. In case any class of employees engaged in hazardous WORK under this CONTRACT at the site of the PROJECT is not protected under Workmen's Compensation statute, the CONTRACTOR shall provide, and shall cause, each SUBCONTRACTOR to provide, adequate and suitable insurance for the protection of his employees not otherwise protected.

21.5 The CONTRACTOR shall also furnish the OWNER with a policy of insurance to cover its contingent liabilities (OWNER'S Protective Liability) to protect the OWNER from any liability arising out of the operations of the CONTRACTOR or of his SUBCONTRACTORS on behalf of the OWNER. Such a policy shall be in amounts not less than those stated in 21.3.1.

21.6 The CONTRACTOR shall secure a Completed Value "Special Form" Builder's Risk Policy with limits equal to 100% of the replacement cost of the WORK. The policy shall name as the insured the CONTRACTOR, the ENGINEER, and the OWNER, as their interests may appear. The Middletown Thrall Library shall be named as loss payee.

21.7 The CONTRACTOR shall either (1) require each of his SUBCONTRACTORS to procure and maintain during the life of his subcontract the insurance as specified in 21.3.1 or (2) insure the activities of his SUBCONTRACTORS in his own policies and furnish evidence of such insurance as provided in section 21.2 with OWNER and ENGINEER listed as additional insured thereon and otherwise meeting the same requirements applicable under section 21.2 above.

21.8 All such insurance policies shall be of the claims accrual type or, if of the claims made type, the CONTRACTOR shall have the additional duty to maintain such policies in effect until the expiration of all applicable statutes of limitations. In addition, all such policies shall contain, when applicable, a waiver of subrogation clause in favor of the OWNER in form acceptable to the **OWNER'S** attorney.

22. CONTRACT SECURITY

22.1 The CONTRACTOR shall within ten (10) days after the receipt of the NOTICE OF AWARD furnish the OWNER with a Performance BOND and a Payment BOND in penal sums equal to the amount of the CONTRACT PRICE, conditioned upon the performance by the CONTRACTOR of all undertakings, covenants, terms, conditions and agreements of the

CONTRACT DOCUMENTS, and upon the prompt payment by the CONTRACTOR to all persons supplying labor and materials in the prosecution of the WORK provided by the CONTRACT DOCUMENTS. Such BONDS shall be executed by the CONTRACTOR and a corporate bonding company licensed to transact such business in the state in which the WORK is to be performed acceptable to the OWNER named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570 and which must have an AM. BEST rating of no less than "A". The expense of the BONDS shall be borne by the CONTRACTOR. If at any time a surety on any such BOND is declared bankrupt or loses its right to do business in the state in which the WORK is to be performed or is removed from the list of Surety Companies accepted on Federal BONDS, CONTRACTOR shall within ten (10) days after notice from the OWNER to do so, substitute an acceptable BOND (or BONDS) in such form and sum and signed by such other surety or sureties as may be acceptable to the OWNER. The premiums on such BOND shall be paid by the CONTRACTOR. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable BOND to the OWNER.

23. ASSIGNMENTS

23.1 The CONTRACTOR shall not sell, transfer, assign or otherwise dispose of the CONTRACT or any portion thereof, or of his right, title or interest therein, or his obligations thereunder, without written consent of the OWNER.

24. INDEMNIFICATIONS

24.1 The CONTRACTOR will indemnify and hold harmless the OWNER and the ENGINEER and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the WORK, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting there from; and is caused in whole or in part by a negligent or willful act or omission of the CONTRACTOR, and SUBCONTRACTOR, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

24.1.1 Any reference to attorney's fees in the CONTRACT DOCUMENTS shall mean reasonable attorney's fees.

24.2 In any and all claims against the OWNER or the ENGINEER, or any of their agents or employees, by any employee of the CONTRACTOR, any SUBCONTRACTOR, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the CONTRACTOR or any SUBCONTRACTOR under workmen's compensation acts, disability benefit acts or other employee benefits acts.

24.3 The obligation of the CONTRACTOR under this paragraph shall not extend to the liability of the ENGINEER, his agents or employees arising out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, CHANGE ORDERS, designs or SPECIFICATIONS.

25. SEPARATE CONTRACTS

25.1 The OWNER reserves the right to let other CONTRACTS in connection with this PROJECT. The CONTRACTOR shall afford other CONTRACTORS reasonable opportunity for the introduction and storage of their materials and the execution of their WORK, and shall properly connect and coordinate his WORK with theirs. If the proper execution or results of any part of the CONTRACTOR'S WORK depends upon the WORK of any other CONTRACTOR, the CONTRACTOR shall inspect and promptly report to the ENGINEER any defects or such WORK that render it unsuitable for such proper execution and results.

25.2 The OWNER may perform additional WORK related to the PROJECT by himself or he may let other CONTRACTS containing provisions similar to these. The CONTRACTOR will afford the other CONTRACTOR's who are parties to such CONTRACTS (for the OWNER, if he is performing the additional WORK himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of WORK, and shall properly connect and coordinate his WORK with theirs.

25.3 If the performance of additional WORK by other CONTRACTORS or the OWNER is not noted in the CONTRACT DOCUMENTS prior to the execution of the CONTRACT, WRITTEN NOTICE thereof shall be given to the CONTRACTOR prior to starting any such additional WORK. If the CONTRACTOR believes that the performance of such additional WORK by the OWNER or others involves him in additional expense or entitles him to an extension of the CONTRACT TIME, he may make a claim therefore as provided in Sections 14 and 15.

26. SUBCONTRACTING

26.1 The CONTRACTOR may utilize the services of specialty SUBCONTRACTORS on those part of the WORK which, under normal contracting practices, are performed by specialty SUBCONTRACTORS.

26.1.1 The CONTRACTOR, before making any subcontract for any portion of the WORK, shall state in writing to the OWNER the name of the proposed SUBCONTRACTOR, the nature and extent of the WORK to be done by such SUBCONTRACTOR, his place of business and such other information as the OWNER may require. The CONTRACTOR shall not award any subcontract until the proposed SUBCONTRACTOR has been approved by the OWNER. The OWNER may, in its discretion, refuse to approve any SUBCONTRACTOR. However, such approval shall not be unreasonably withheld, except as provided in section 26.2.1 below.

26.2 The CONTRACTOR shall not award WORK to SUBCONTRACTOR(S), in excess of fifty (50) percent of the CONTRACT PRICE, without prior written approval of the OWNER.

26.2.1 The OWNER reserves the right to withhold approval of subcontracts, to the extent the sum total of such subcontracts exceed 50% of this CONTRACT, and to require the CONTRACTOR to perform directly with his own employees not less than 50% of the total value of the WORK. The right to withhold approval under this section is absolute and the same may be withheld without cause.

26.2.2 The CONTRACTOR shall give his attention constantly to the faithful prosecution of the WORK, shall keep the same under his personal control, shall not subcontract the WORK or any part thereof without previous written consent of the OWNER and shall not either legally or equitably assign any of the monies payable under this CONTRACT or his claim thereto unless by and with the written consent of the OWNER. In case the CONTRACTOR assigns all or any part of the monies due orto become due under this CONTRACT, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the CONTRACTOR shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the WORK called for in this CONTRACT.

26.3 The CONTRACTOR shall be fully responsible to the OWNER for the acts and omissions of his SUBCONTRACTORS, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

26.4 The CONTRACTOR shall cause appropriate provisions to be inserted in all subcontracts relative to the WORK to bind SUBCONTRACTORS to the CONTRACTOR by the terms of the CONTRACT DOCUMENTS insofar as applicable to the WORK of SUBCONTRACTORS and to give the CONTRACTOR the same power as regards terminating any subcontract that

the OWNER may exercise over the CONTRACTOR under the provision of the CONTRACT DOCUMENT.

26.5 Nothing contained in this CONTRACT shall create any contractual relation between any SUBCONTRACTOR and the OWNER.

26.6 The CONTRACTOR will insert in any subcontracts the Federal Labor Standards Provision contained herein and such other clauses as the Department of Housing and Urban Development may, by instructions, require and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made.

27. ENGINEER'S AUTHORITY

27.1 The ENGINEER shall act as the OWNER's representative during the construction period. He shall decide questions which may arise as to quality and acceptability of materials furnished and WORK performed. He shall interpret the intent of the CONTRACT DOCUMENTS in a fair and unbiased manner. The ENGINEER will make visits to the site and determine if the WORK is proceeding in accordance with the CONTRACT DOCUMENTS.

27.2 The CONTRACTOR will be held strictly to the intent of the CONTRACT DOCUMENTS in regard to the quality of materials, workmanship and execution of the WORK. Inspections may be made at the factory or fabrication plant of the source of material supply.

27.3 The ENGINEER will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

27.4 The ENGINEER and OWNER shall promptly make decisions relative to interpretation of the CONTRACT DOCUMENTS.

28. LAND AND RIGHTS-OF-WAY

28.1 Prior to issuance of NOTICE TO PROCEED, the OWNER shall obtain all land and rights-of-way necessary for carrying out and for the completion of the WORK to be performed pursuant to the CONTRACT DOCUMENTS, unless otherwise mutually agreed.

28.2 The OWNER shall provide to the CONTRACTOR information which delineates and describes the lands owned and rights-of-way acquired.

28.3 The CONTRACTOR shall provide at his own expense and without liability to the OWNER any additional land and access thereto that the CONTRACTOR may desire for temporary construction facilities, or for storage of materials.

29. GUARANTEE

29.1 Without limiting the OWNER'S other legal remedies, the CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION, or the date of the last payment made by the OWNER hereunder, whichever is later. The CONTRACTOR warrants and guarantees for a period of one (1) year from the date of SUBSTANTIAL COMPLETION of the WORK that the PROJECT is free from all defects due to faulty materials or workmanship and the CONTRACTOR shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the PROJECT resulting from such defects. In the event that the CONTRACTOR should fail to make such repairs, adjustments or other work that may be made necessary by such defects, the OWNER may do so and charge the CONTRACTOR the cost thereby incurred. The Performance BOND shall remain in full force and effect through the guarantee period.

29.2 Neither the foregoing nor any provision of these CONTRACT DOCUMENTS, nor any special guarantee time limit, shall be held to limit the CONTRACTOR'S liability for defects to less than the legal limit of liability in accordance with the laws of the State of New York.

30. TAXES

30.1 The CONTRACTOR will pay all sales, consumer, use and other similar taxes required by the law of the place where the WORK is performed.

31. JURISDICTION

31.1 All claims, disputes and other matters in question arising out of or relating to the CONTRACT DOCUMENTS or the breach thereof, except for claims that have been waived by the making and acceptance of final payment as provided by Paragraph 20 shall be decided by an action in the Supreme Court of the State of New York in Orange County to be held and to be tried without a jury. The parties agree and understand that Supreme Court, State of New York shall have exclusive jurisdiction over all matters relating to this agreement and that the time of the commencement of any action in Supreme Court shall be limited to six (6) months from the date of the issuance of the final payment check or SUBSTANTIAL COMPLETION, whichever occurs first.

32. CONTRACT AND CONTRACT DOCUMENTS

32.1 The DRAWINGS, SPECIFICATIONS and Addenda, including all CONTRACT DOCUMENTS as enumerated in the Agreement, shall form part of this CONTRACT and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth. The table of contents, titles and headings contained herein in said DOCUMENTS are solely to facilitate reference to various provisions of the CONTRACT DOCUMENTS and in no way affect, limit or cast light on the interpretation of the provisions to which they refer.

33. ACQUISITION OF PLANS AND SPECIFICATIONS BY CONTRACTOR

33.1 After the CONTRACT has been executed, the OWNER shall furnish the CONTRACTOR five (5) copies of the CONTRACT DOCUMENTS. Additional copies will be furnished, upon request, at the cost of reproduction.

33.2 The CONTRACTOR shall furnish each of his SUBCONTRACTORS, manufacturers and material men such copies of the CONTRACT DOCUMENTS as may be required for their WORK.

34. QUANTITIES AND ESTIMATES

34.1 Wherever the estimated quantities of WORK to be done and materials to be furnished under this CONTRACT are shown in any of the DOCUMENTS including the BID/TENDER FORMS, they are given for use in comparing bids and the right is especially reserved except as herein otherwise specifically limited, to increase or diminish them as may be deemed reasonably necessary or desirable by the OWNER to complete the WORK contemplated by this CONTRACT, and such increase or reduction shall in no way invalidate this CONTRACT, nor shall any such increase or diminution give cause for claims or liability for damage.

34.2 In entering into this CONTRACT, the CONTRACTOR agrees that the quantities of WORK as stated in the BID/TENDER FORMS, or indicated on the DRAWINGS, are only approximate and that during the WORK the OWNER may find it advisable, and shall have the right to make such changes in or additions to the PLANS and the character or quantity of the WORK as may be considered necessary or desirable. Should any changes be made as provided herein, the CONTRACTOR shall perform the WORK as altered, increased or decreased at

the CONTRACT unit prices. In no event shall any modification in the WORK shown on the DRAWINGS and SPECIFICATIONS be made unless the nature and extent thereof has first been certified by the ENGINEER in writing and sent to the CONTRACTOR.

34.3 If unit prices are stated in the CONTRACT DOCUMENTS or subsequently agreed upon, and if the quantities originally stated in the estimate are overrun or under run, by unforeseen conditions of the WORK, by amount greater than 20 percent, the applicable unit prices may be adjusted. Adjustments in unit prices shall be determined in accordance with the provisions of Section 14.1. No adjustments in unit prices will be made by quantity overruns resulting from material which is lost or not incorporated in the WORK, or material placed or excavation beyond CONTRACT payment limits or which is unnecessary for the performance of the WORK, as determined by the ENGINEER.

35. CONTRACTOR'S CLAIM FOR DAMAGE

35.1 If the CONTRACTOR shall claim compensation for any alleged damage sustained by reason of acts of the OWNER or its agents, the CONTRACTOR immediately shall notify the ENGINEER and the OWNER of the alleged damages so that proper appraisal can be made and within five (5) days after the sustaining of such alleged damage, make a written statement to the ENGINEER of the nature of the damages sustained. On or before the fifteenth (15th) day of the month succeeding that in which the alleged damage shall have been sustained the CONTRACTOR shall file with the ENGINEER an itemized statement of the details and amounts of such damage, and unless such statement shall be made as thus required, his claim for compensation shall be forfeited and invalidated, and he shall not be entitled to payment on account of any such alleged damage.

36. REQUIRED PROVISIONS DEEMED INSERTED

36.1 If this CONTRACT contains any unlawful provisions not an essential part of the general structure of the CONTRACT and which shall not appear to have been a controlling or material inducement in the making thereof, the same shall be deemed of no effect and shall be deemed stricken from the CONTRACT without affecting the binding force of the remainder. It is the intent and understanding of the parties to this CONTRACT, and it is hereby stipulated, that each and every provision of law required to be inserted in the CONTRACT is deemed to be inserted herein and if any such provision is not inserted in the correct form, then this CONTRACT shall be deemed amended by such insertion. Upon application of either party, the CONTRACT shall forthwith by physically amended by making such insertion.

37. NO ESCALATION ALLOWANCE FOR LABOR OR MATERIAL

37.1 The CONTRACTOR shall make allowance in his bid for any price increase in labor and materials. Requisitions for work and materials shall be based on price bid, with no additional charges to the OWNER for such increases, but with decreases in price to be subject to Article 8 of the General Conditions.

38. LAWS AND REGULATIONS

38.1 The CONTRACTOR shall keep himself fully informed of all Federal, State and municipal law, ordinances and regulations in any manner affecting those engaged or employed in the WORK, the materials used in the WORK or the conduct of the WORK, and of all orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency is discovered in the CONTRACT DOCUMENTS in relation to such laws, ordinances, regulations, orders or decrees, he shall forthwith report the same to the ENGINEER in writing. He shall at all times observe and comply with and shall cause all his agents and employees to observe and comply with all such laws, ordinances, regulations,

orders and decrees and shall protect and indemnify the OWNER and its officers and agents and servants against any claim, liability or expense, including reasonable attorney's fees, arising from or based on the violation of such laws, ordinances, regulations, orders or decrees whether by himself or his employees or SUBCONTRACTORS.

39. SANITARY PRECAUTIONS

39.1 Sanitary conveniences for the use of all persons employed on the WORK, properly screened from public observation, shall be provided by the CONTRACTOR in sufficient numbers in such manner and at such points as shall be approved. The contents shall be removed and disposed of by the CONTRACTOR in a satisfactory manner as the occasion requires. The CONTRACTOR shall rigorously prohibit the committing of nuisances within, on or about the WORK. All employees found violating these provisions shall be discharged and not again employed on the WORK without the written consent of the ENGINEER.

39.2 The CONTRACTOR shall supply sufficient drinking water from approved sources to all of his employees and SUBCONTRACTORS.

39.3 The sanitary conveniences specified above shall be the obligation and responsibility of the CONTRACTOR until the completion of the WORK. The facilities shall be made available to all other CONTRACTORS and SUBCONTRACTORS.

40. EXTENSION OF TIME: NO WAIVER

40.1 If the CONTRACTOR shall be delayed in the completion of his WORK by reason of "unforeseeable causes", the time of completion of his WORK shall be extended by such time as shall be fixed by the OWNER and forwarded to the CONTRACTOR in writing. "Unforeseeable causes" are those which are beyond CONTRACTOR'S control and without his fault or negligence, including, but not restricted to, acts of God or of the public enemy, acts of neglect of the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, riots, civil commotions or freight embargoes.

40.2 No such extension of time shall be deemed a waiver by the OWNER of his right to terminate the CONTRACT for abandonment or delay by the CONTRACTOR as herein provided or relieve the CONTRACTOR from full responsibility for performance of his obligations hereunder.

41. WAIVER

41.1 Neither the inspection by the OWNER or ENGINEER or any of their employees, nor any act or thing done by the OWNER, other than an express waiver, shall operate as a waiver of any provision of this CONTRACT, nor shall any waiver of any breach of this CONTRACT be held to be a waiver of any other or subsequent breach. Any remedy provided in this CONTRACT shall be taken and construed as cumulative, that is, in addition to each and every other remedy herein provided.

42. LEGAL ADDRESS OF CONTRACTOR

42.1 Both the address given in the BID/TENDER FORMS, upon which this CONTRACT is based, and the CONTRACTOR'S office at or near the SITE are hereby designated as places to either of which notices, letters and other communications to the CONTRACTOR shall be certified, mailed or delivered. The delivering at the above-named place, depositing in a postpaid wrapper directly to the first named place or in any post office box regularly maintained by the Post Office Department of any notice, letter or other communication to the CONTRACTOR shall be deemed sufficient service thereof upon the CONTRACTOR, and the date of said service shall be the date of such delivery or mailing. The first named address may be changed at any time by an instrument in writing, executed and acknowledged by the

CONTRACTOR, and delivered to the ENGINEER. Nothing herein contained shall be deemed to preclude or render inoperative the service of any notice, letter or other communication upon the CONTRACTOR personally.

43. WEATHER CONDITIONS

43.1 In the event of temporary suspension of work, or during inclement weather, or whenever the ENGINEER shall direct, the CONTRACTOR will and will cause his SUBCONTRACTORS to protect carefully his and their work and materials against damage or injury from the weather. If any work or materials shall have been damaged or injured by reason of failure on the part of the CONTRACTOR or any of his SUBCONTRACTORS to so protect his work, such materials shall be removed and replaced at the expense of the CONTRACTOR.

44. CERTIFICATE Of COMF'LETION

44.1 Upon substantial completion of all WORK whatsoever required, including extra WORK ordered, the ENGINEER shall file a written certification with the OWNER and with the CONTRACTOR as to the date of completion.

45. RIGHT TO OPERATE

45.1 As soon as PROJECT is ready for use, the OWNER shall have the right to operate the PROJECT. Such operation shall in no way constitute acceptance of the WORK or any portion thereof and shall not release the CONTRACTOR from the fulfillment of all his obligations under this CONTRACT.

45.2 The execution of the bonds shall be understood to demonstrate the consent of the surety to such operation of the PROJECT.

45.3 The insurance carrier shall provide an endorsement permitting occupancy of the building or use of the PROJECT during the remaining period of construction.

46. MUTUAL RESPONSIBILITY OF CONTRACTORS

46.1 If, through acts of neglect on the part of the CONTRACTOR, any other contractor or any SUBCONTRACTOR shall suffer loss or damage on the WORK, the CONTRACTOR agrees to settle with such other contractor or SUBCONTRACTOR by agreement or arbitration if such other contractor or SUBCONTRACTOR will settle. If such other contractor or SUBCONTRACTOR shall assert any claim against the OWNER on account of any damage alleged to have been sustained, the OWNER shall notify the CONTRACTOR who shall indemnify and save harmless the OWNER against any such claim, including reasonable attorney's fees.

47. RESPONSIBILITY FOR WORK

47.1 The CONTRACTOR shall take all responsibility for the WORK and take all precautions for preventing injuries to persons and property in or about the WORK, shall bear all losses resulting to him on account of the amount or character of the WORK, or because the nature of the land in or on which the WORK is done is different from what was estimated or expected, or because unexpected underground obstructions or structures are encountered, or on account of the weather, elements or other cause.

47.2 The WORK shall be entirely at the CONTRACTOR'S risk until the same is fully completed and accepted, and he will be held liable to an amount not less than the OWNER'S interest in the same as shown by payments on account.

47.3 All the provisions, terms, covenants and conditions of the CONTRACT shall be interpreted according to the laws of the State of New York.

48. MONEY TO BE RETAINED

48.1 The OWNER may keep all monies which would otherwise be payable at any time hereunder and apply the same, or so much as may be necessary therefore, to the payment of any expense, loss or damage incurred by the OWNER and determined as herein provided and may retain until all claims are settled so much of such monies as in the opinion of the OWNER will be required to settle all claims against the OWNER and its officers and agents, and all claims for labor and materials used or employed on the WORK and all appliances and equipment employed in the WORK, filed in accordance with the State and local laws or the OWNER may make such settlements and apply thereto any of the monies retained under this CONTRACT. Should the CONTRACTOR neglect to pay any undisputed claim, made in writing to the OWNER within thirty (30) days after completion of the WORK, but continuing unsatisfied for a period of sixty (60) days, the OWNER may pay such claims and deduct the amount thereof from the balance due the CONTRACTOR. The OWNER may also, with the written consent of the CONTRACTOR, use any of the monies retained, due or to become due under this CONTRACT for the purpose of paying for both labor and materials for the WORK, for which claims have not been filed.

48.2 Security is provided both by the payment bond and the power of the OWNER to retain any of the monies for claims, but payment by one shall in no way impair or discharge the liability of the other.

48.3 Any and all liens for WORK and materials may be paid off by the OWNER within a reasonable time after filing for record, in accordance with State and local laws, a notice of such liens except where the claim on which the lien is filed is being litigated by the CONTRACTOR, and in such case the OWNER may pay the amount of any final judgment or decree of any such claim within a reasonable time after such final judgment or decree of any such claim shall be rendered.

48.4 All monies paid by the OWNER in settlement of liens as aforesaid, with the costs and expenses incurred by the OWNER in connection therewith, shall be charged to the CONTRACTOR, shall bear interest and shall be deducted from the next payment due the CONTRACTOR under the terms of this CONTRACT.

49. MONEY FOR REPAIRS

49.1 The Owner shall withhold in escrow 5% of the completed WORK for the express use of the OWNER to make repairs or restitution of the claims as hereinafter provided for a one (1) year guarantee period. The CONTRACTOR shall have the option of substituting bearer bonds equal to the retainages held for said one year guarantee period.

49.2 The CONTRACTOR guarantees that the WORK will be free of defects in workmanship and material for a period of one (1) year after SUBSTANTIAL COMPLETION (the "Guarantee").

49.3 If, at any time prior to or within the period of the Guarantee, any part of the WORK shall, in the opinion of the OWNER, require repair or replacement, the OWNER may notify the CONTRACTOR in writing to make the required repair or replacement. If the CONTRACTOR shall neglect to make such repair or replacement to the satisfaction of the ENGINEER within three (3) days from the date of giving or mailing such notice, then the OWNER may employ other persons to make the same. The OWNER shall pay the expenses of the same out of the escrow sum or will call the bond, as the case may be. Upon the expiration of the period of the Guarantee, provided that the WORK at that time shall be in good order, the

CONTRACTOR shall be entitled to receive the whole or such part of the sum last aforesaid as may remain after the expense of making said repairs, in the manner aforesaid, shall have been paid there from.

49.4 It is, however, agreed that the OWNER may apply or keep the escrow sum to or for payment of other claims arising and made payable by the CONTRACTOR under provisions of this CONTRACT but remaining unsatisfied.

49.5 The CONTRACTOR'S liability under the Guarantee is not limited to the amount of the bond or escrow, as the case may be.

50. ANTI-KICKBACK PROVISIONS AND WAGE RATES

50.1 The Anti-Kickback Regulations issued by the Secretary of Labor (29CFR, Part 3) are applicable to this CONTRACT. The CONTRACTOR will comply with these Regulations and any amendments or modifications thereof, will cause appropriate provisions to be inserted in SUBCONTRACTS to insure compliance therewith by all SUBCONTRACTORS subject thereof, and will be responsible for the submission of affidavits required of SUBCONTRACTORS thereunder, except as the Secretary of Labor may specifically provide for reasonable limitations, variations, tolerances and exemptions from the requirements thereof. In lieu of mailing affidavits required by Section 3.3 and 3.4 of the Anti-Kickback Regulations to any Federal Agency, the CONTRACTOR shall submit all such affidavits promptly as specified to the OWNER or to a representative designated by the OWNER.

50.2 The OWNER, or his representative, may withhold or cause to be withheld from the CONTRACTOR so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics employed by the CONTRACTOR, or any SUBCONTRACTOR, on the work (except for such deductions as are permitted by the Anti-Kickback Regulations 29CFR, Part 3) the full amount of wages to which they are entitled under their Contracts of employment. In the event of failure to pay any laborer or mechanic employed or working on the SITE all or part of the wages to which he is entitled under his Contract of employment, the OWNER, or his representative, may, after written notice to the CONTRACTOR, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

50.3 Payroll records shall contain the information and be preserved as required by Section 3.4(b) of the Regulations. The CONTRACTOR will make his employment records available for inspection by authorized representatives of the New York State Department of Health and will permit such representatives to interview employees during working hours on the job.

50.4 The CONTRACTOR will insert in each of his subcontracts the provisions set forth in the foregoing clauses hereof.

50.5 A breach of stipulations 50.1 through 50.4 may be grounds for termination of the CONTRACT.

50.6 The attention of the CONTRACTOR is called to Article 8, Section 220 of the Labor Law, as amended by Chapter 750 of the Laws of 1956, which provides, among other things that it shall be the duty of the fiscal officer to make a determination of the schedule of wages paid to all laborers, workmen and mechanics employed on public work projects, including supplements for welfare, pension and other benefits. These supplements include hospital, surgical or medical insurance or benefits, life insurance or death benefits, accidental death or dismemberment insurance, and pension or retirement benefits. If the amount of supplements provided by the employer is less than the total supplements shown on the wage schedule, the difference shall be paid in cash to employees. Article 8, Section 220 of the Labor Law, as amended by Chapter 750 of the Laws of 1956, also provides that the supplements to be provided to laborers, workmen and mechanics upon public work..."Shall be in accordance with the prevailing practices in the locality...". The amounts for supplements listed on the enclosed schedule does not necessarily include all types of

prevailing supplements in the locality, and a future determination of the Industrial Commissioner may require the CONTRACTOR to provide additional supplements.

50.7 The CONTRACTOR shall provide statutory benefits for disability, Worker's Compensation, Unemployment Insurance and Social Security.

50.8 Any person, or corporation, that willfully pays, after entering into such contract, less than his established wage schedule shall be guilty of a misdemeanor and, upon conviction, shall be punished for such offense by a fine of Five Hundred Dollars ($500) or by imprisonment for not more than 30 days or both fine and imprisonment. A second offense carries heavier penalties.

50.9 In case it becomes necessary for the CONTRACTOR or any SUBCONTRACTOR to employ on the PROJECT under this CONTRACT, any person in trade or occupation (except executive, supervisory, administrative, clerical, or other non-manual Worker's, as such) for which no minimum wage rate is herein specified, the CONTRACTOR shall immediately notify the OWNER, who will promptly thereafter furnish the CONTRACTOR with the minimum rate. The minimum rate thus furnished shall be applicable as a minimum for such trade or occupation from the time of the initial employment of the person affected and during the continuance of such employment.

50.10 The CONTRACTOR shall take out and maintain during the life of the CONTRACT, the Worker's Compensation Insurance in conformity with the provisions of the Worker's Compensation Law of the State of New York, for all his employees engaged in work under this CONTRACT, and in case any such work is sublet, the CONTRACTOR shall require all SUBCONTRACTORS engaged in work under this CONTRACT to provide similar statutory Worker's Compensation and Employer's Liability Insurance.

50.11 There shall be paid each employee engaged in work on this PROJECT, in the grade or occupation listed on the following schedule, not less than the wage so listed for that trade or occupation.

51. ACCESS TO WORK

51.1 If the CONTRACTOR requires access to the work other than through the SITE easements and public right-of-ways furnished, he must secure such rights at his own expense. Copies of any rights obtained must be filed with the OWNER.

51.2 The CONTRACTOR shall provide safe access to the work for inspection and for other trades which will require such access throughout the course of the PROJECT.

52. INSPECTION

52.1 Authorized agents and representatives of the OWNER and ENGINEER shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials and other relevant data and records.

53. REQUIREMENTS OF NEW YORK STATE DEPARTMENT OF LABOR, INDUSTRIAL CODES NO. 23 AND 53

53.1 The CONTRACTOR shall acquaint himself with the applicable requirements of New York State Department of Labor Industrial Code Rules 23 and 53 and Applicable OSHA requirements.

SECTION 08000- AIA DOCUMENT A201

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

AIA DOCUMENT A201

AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

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

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

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

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

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent

consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements,

assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

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

§ 3.3 Supervision and Construction Procedures

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

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

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

§ 3.4 Labor and Materials

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

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

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

§ 3.5 Warranty

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

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

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

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

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

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

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the

Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work
The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights
The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification
§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT
§ 4.1 General
§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract
§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the

Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations

and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor,

prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work,

promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will

affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and

unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to

the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the

Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 00825 - PREVAILING WAGE RATES

0.01 GENERAL

A. Wage rates shall apply as shown in the following prevailing rate schedule prepared by the State of New York Department of Labor.

B. The Contractor shall be responsible for completing one copy of the form PW-16, the identification number is in small print and is located in the bottom left corner of the form, enclosed as part of the prevailing wage rate package. Leave the "CONTRACTS NOT YET AWARDED" section blank. Upon Completion the contractor shall mail the form to the architect/engineer for record keeping and for forwarding on to the New York State Department of Labor.

Middletown Thrall Library

Lois Matthews
LAN Associates, EPAS, LLP
Office Manager
252 Main Street
Goshen NY 10924

Schedule Year	2023 through 2024
Date Requested	02/28/2024
PRC#	2024002466

Location	11 Depot Street
Project ID#	4.1603.02
Project Type	HVAC Upgrades at Thrall Library

PREVAILING WAGE SCHEDULE FOR ARTICLE 8 PUBLIC WORK PROJECT

Attached is the current schedule(s) of the prevailing wage rates and prevailing hourly supplements for the project referenced above. A unique Prevailing Wage Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2023 through June 2024. All updates, corrections, posted on the 1st business day of each month, and future copies of the annual determination are available on the Department's website www.labor.ny.gov. Updated PDF copies of your schedule can be accessed by entering your assigned PRC# at the proper location on the website.

It is the responsibility of the contracting agency or its agent to annex and make part, the attached schedule, to the specifications for this project, when it is advertised for bids and /or to forward said schedules to the successful bidder(s), immediately upon receipt, in order to insure the proper payment of wages.

Please refer to the "General Provisions of Laws Covering Workers on Public Work Contracts" provided with this schedule, for the specific details relating to other responsibilities of the Department of Jurisdiction.

Upon completion or cancellation of this project, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

NOTICE OF COMPLETION / CANCELLATION OF PROJECT

Date Completed: _____ Date Cancelled: _____

Name & Title of Representative: _____

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12226

General Provisions of Laws Covering Workers on Article 8 Public Work Contracts

Introduction

The Labor Law requires public work contractors and subcontractors to pay laborers, workers, or mechanics employed in the performance of a public work contract not less than the prevailing rate of wage and supplements (fringe benefits) in the locality where the work is performed.

Responsibilities of the Department of Jurisdiction

A Department of Jurisdiction (Contracting Agency) includes a state department, agency, board or commission: a county, city, town or village; a school district, board of education or board of cooperative educational services; a sewer, water, fire, improvement and other district corporation; a public benefit corporation; and a public authority awarding a public work contract.

The Department of Jurisdiction (Contracting Agency) awarding a public work contract MUST obtain a Prevailing Rate Schedule listing the hourly rates of wages and supplements due the workers to be employed on a public work project. This schedule may be obtained by completing and forwarding a "Request for wage and Supplement Information" form (PW 39) to the Bureau of Public Work. The Prevailing Rate Schedule MUST be included in the specifications for the contract to be awarded and is deemed part of the public work contract.

Upon the awarding of the contract, the law requires that the Department of Jurisdiction (Contracting Agency) furnish the following information to the Bureau: the name and address of the contractor, the date the contract was let and the approximate dollar value of the contract. To facilitate compliance with this provision of the Labor Law, a copy of the Department's "Notice of Contract Award" form (PW 16) is provided with the original Prevailing Rate Schedule.

The Department of Jurisdiction (Contracting Agency) is required to notify the Bureau of the completion or cancellation of any public work project. The Department's PW 200 form is provided for that purpose.

Both the PW 16 and PW 200 forms are available for completion online.

Hours

No laborer, worker, or mechanic in the employ of a contractor or subcontractor engaged in the performance of any public work project shall be permitted to work more than eight hours in any day or more than five days in any week, except in cases of extraordinary emergency. The contractor and the Department of Jurisdiction (Contracting Agency) may apply to the Bureau of Public Work for a dispensation permitting workers to work additional hours or days per week on a particular public work project.

Wages and Supplements

The wages and supplements to be paid and/or provided to laborers, workers, and mechanics employed on a public work project shall be not less than those listed in the current Prevailing Rate Schedule for the locality where the work is performed. If a prime contractor on a public work project has not been provided with a Prevailing Rate Schedule, the contractor must notify the Department of Jurisdiction (Contracting Agency) who in turn must request an original Prevailing Rate Schedule form the Bureau of Public Work. Requests may be submitted by: mail to NYSDOL, Bureau of Public Work, State Office Bldg. Campus, Bldg. 12, Rm. 130, Albany, NY 12226; Fax to Bureau of Public Work (518) 485-1870; or electronically at the NYSDOL website www.labor.ny.gov.

Upon receiving the original schedule, the Department of Jurisdiction (Contracting Agency) is REQUIRED to provide complete copies to all prime contractors who in turn MUST, by law, provide copies of all applicable county schedules to each subcontractor and obtain from each subcontractor, an affidavit certifying such schedules were received. If the original schedule expired, the contractor may obtain a copy of the new annual determination from the NYSDOL website www.labor.ny.gov.

The Commissioner of Labor makes an annual determination of the prevailing rates. This determination is in effect from July 1st through June 30th of the following year. The annual determination is available on the NYSDOL website www.labor.ny.gov.

Payrolls and Payroll Records

Every contractor and subcontractor MUST keep original payrolls or transcripts subscribed and affirmed as true under penalty of perjury. As per Article 6 of the Labor law, contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemperaneous, true, and accurate payroll records. At a minimum, payrolls must show the following information for each person employed on a public work project: Name, Address, Last 4 Digits of Social Security Number, Classification(s) in which the worker was employed, Hourly wage rate(s) paid, Supplements paid or provided, and Daily and weekly number of hours worked in each classification.

The filing of payrolls to the Department of Jurisdiction is a condition of payment.Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury. The Department of Jurisdiction (Contracting Agency) shall collect, review for facial validity, and maintain such payrolls.

In addition, the Commissioner of Labor may require contractors to furnish, with ten (10) days of a request, payroll records sworn to as their validity and accuracy for public work and private work. Payroll records include, but are not limited to time cards, work description sheets, proof that supplements were provided, cancelled payroll checks and payrolls. Failure to provide the requested information within the allotted ten (10) days will result in the withholding of up to 25% of the contract, not to exceed $100,000.00. If the contractor or subcontractor does not maintain a place of business in New York State and the amount of the contract exceeds $25,000.00, payroll records and certifications must be kept on the project worksite.

The prime contractor is responsible for any underpayments of prevailing wages or supplements by any subcontractor.

All contractors or their subcontractors shall provide to their subcontractors a copy of the Prevailing Rate Schedule specified in the public work contract as well as any subsequently issued schedules. A failure to provide these schedules by a contractor or subcontractor is a violation of Article 8, Section 220-a of the Labor Law.

All subcontractors engaged by a public work project contractor or its subcontractor, upon receipt of the original schedule and any subsequently issued schedules, shall provide to such contractor a verified statement attesting that the subcontractor has received the Prevailing Rate Schedule and will pay or provide the applicable rates of wages and supplements specified therein. (See NYS Labor Laws, Article 8 . Section 220-a).

Determination of Prevailing Wage and Supplement Rate Updates Applicable to All Counties

The wages and supplements contained in the annual determination become effective July 1st whether or not the new determination has been received by a given contractor. Care should be taken to review the rates for obvious errors. Any corrections should be brought to the Department's attention immediately. It is the responsibility of the public work contractor to use the proper rates. If there is a question on the proper classification to be used, please call the district office located nearest the project. Any errors in the annual determination will be corrected and posted to the NYSDOL website on the first business day of each month. Contractors are responsible for paying these updated rates as well, retroactive to July 1st.

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. To the extent possible, the Department posts rates in its possession that cover periods of time beyond the July 1st to June 30th time frame covered by a particular annual determination. Rates that extend beyond that instant time period are informational ONLY and may be updated in future annual determinations that actually cover the then appropriate July 1st to June 30th time period.

Withholding of Payments

When a complaint is filed with the Commissioner of Labor alleging the failure of a contractor or subcontractor to pay or provide the prevailing wages or supplements, or when the Commissioner of Labor believes that unpaid wages or supplements may be due, payments on the public work contract shall be withheld from the prime contractor in a sufficient amount to satisfy the alleged unpaid wages and supplements, including interest and civil penalty, pending a final determination.

When the Bureau of Public Work finds that a contractor or subcontractor on a public work project failed to pay or provide the requisite prevailing wages or supplements, the Bureau is authorized by Sections 220-b and 235.2 of the Labor Law to so notify the financial officer of the Department of Jurisdiction (Contracting Agency) that awarded the public work contract. Such officer MUST then withhold or cause to be withheld from any payment due the prime contractor on account of such contract the amount indicated by the Bureau as sufficient to satisfy the unpaid wages and supplements, including interest and any civil penalty that may be assessed by the Commissioner of Labor. The withholding continues until there is a final determination of the underpayment by the Commissioner of Labor or by the court in the event a legal proceeding is instituted for review of the determination of the Commissioner of Labor.

The Department of Jurisdiction (Contracting Agency) shall comply with this order of the Commissioner of Labor or of the court with respect to the release of the funds so withheld.

Summary of Notice Posting Requirements

The current Prevailing Rate Schedule must be posted in a prominent and accessible place on the site of the public work project. The prevailing wage schedule must be encased in, or constructed of, materials capable of withstanding adverse weather conditions and be titled "PREVAILING RATE OF WAGES" in letters no smaller than two (2) inches by two (2) inches.

The "Public Work Project" notice must be posted at the beginning of the performance of every public work contract, on each job site.

Every employer providing workers. compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers. Compensation Board in a conspicuous place on the jobsite.

Every employer subject to the NYS Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers, notices furnished by the State Division of Human Rights.

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the NYS Department of Labor.

Apprentices

Employees cannot be paid apprentice rates unless they are individually registered in a program registered with the NYS Commissioner of Labor. The allowable ratio of apprentices to journeyworkers in any craft classification can be no greater than the statewide building trade ratios promulgated by the Department of Labor and included with the Prevailing Rate Schedule. An employee listed on a payroll as an apprentice who is not registered as above or is performing work outside the classification of work for which the apprentice is indentured, must be paid the prevailing journeyworker's wage rate for the classification of work the employee is actually performing.

NYSDOL Labor Law, Article 8, Section 220-3, require that only apprentices individually registered with the NYS Department of Labor may be paid apprenticeship rates on a public work project. No other Federal or State Agency of office registers apprentices in New York State.

Persons wishing to verify the apprentice registration of any person must do so in writing by mail, to the NYSDOL Office of Employability Development / Apprenticeship Training, State Office Bldg. Campus, Bldg. 12, Albany, NY 12226 or by Fax to NYSDOL Apprenticeship Training (518) 457-7154. All requests for verification must include the name and social security number of the person for whom the information is requested.

The only conclusive proof of individual apprentice registration is written verification from the NYSDOL Apprenticeship Training Albany Central office. Neither Federal nor State Apprenticeship Training offices outside of Albany can provide conclusive registration information.

It should be noted that the existence of a registered apprenticeship program is not conclusive proof that any person is registered in that program. Furthermore, the existence or possession of wallet cards, identification cards, or copies of state forms is not conclusive proof of the registration of any person as an apprentice.

Interest and Penalties

In the event that an underpayment of wages and/or supplements is found:

- Interest shall be assessed at the rate then in effect as prescribed by the Superintendent of Banks pursuant to section 14-a of the Banking Law, per annum from the date of underpayment to the date restitution is made.
- A Civil Penalty may also be assessed, not to exceed 25% of the total of wages, supplements, and interest due.

Debarment

Any contractor or subcontractor and/or its successor shall be ineligible to submit a bid on or be awarded any public work contract or subcontract with any state, municipal corporation or public body for a period of five (5) years when:

- Two (2) willful determinations have been rendered against that contractor or subcontractor and/or its successor within any consecutive six (6) year period.
- There is any willful determination that involves the falsification of payroll records or the kickback of wages or supplements.

Criminal Sanctions

Willful violations of the Prevailing Wage Law (Article 8 of the Labor Law) may be a felony punishable by fine or imprisonment of up to 15 years, or both.

Discrimination

No employee or applicant for employment may be discriminated against on account of age, race, creed, color, national origin, sex, disability or marital status.

No contractor, subcontractor nor any person acting on its behalf, shall by reason of race, creed, color, disability, sex or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates (NYS Labor Law, Article 8, Section 220-e(a)).

No contractor, subcontractor, nor any person acting on its behalf, shall in any manner, discriminate against or intimidate any employee on account of race, creed, color, disability, sex, or national origin (NYS Labor Law, Article 8, Section 220-e(b)).

The Human Rights Law also prohibits discrimination in employment because of age, marital status, or religion.

There may be deducted from the amount payable to the contractor under the contract a penalty of $50.00 for each calendar day during which such person was discriminated against or intimidated in violation of the provision of the contract (NYS Labor Law, Article 8, Section 220-e(c)).

The contract may be cancelled or terminated by the State or municipality. All monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of the anti-discrimination sections of the contract (NYS Labor Law, Article 8, Section 220-e(d)).

Every employer subject to the New York State Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers notices furnished by the State Division of Human Rights.

Workers' Compensation

In accordance with Section 142 of the State Finance Law, the contractor shall maintain coverage during the life of the contract for the benefit of such employees as required by the provisions of the New York State Workers' Compensation Law.

A contractor who is awarded a public work contract must provide proof of workers' compensation coverage prior to being allowed to begin work.

The insurance policy must be issued by a company authorized to provide workers' compensation coverage in New York State. Proof of coverage must be on form C-105.2 (Certificate of Workers' Compensation Insurance) and must name this agency as a certificate holder.

If New York State coverage is added to an existing out-of-state policy, it can only be added to a policy from a company authorized to write workers' compensation coverage in this state. The coverage must be listed under item 3A of the information page.

The contractor must maintain proof that subcontractors doing work covered under this contract secured and maintained a workers' compensation policy for all employees working in New York State.

Every employer providing worker's compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers' Compensation Board in a conspicuous place on the jobsite.

Unemployment Insurance

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the New York State Department of Labor.

Kathy Hochul, Governor

Roberta Reardon, Commissioner

Middletown Thrall Library

Lois Matthews
LAN Associates, EPAS, LLP
Office Manager
252 Main Street
Goshen NY 10924

Schedule Year 2023 through 2024
Date Requested 02/28/2024
PRC# 2024002466

Location 11 Depot Street
Project ID# 4.1603.02
Project Type HVAC Upgrades at Thrall Library

Notice of Contract Award

New York State Labor Law, Article 8, Section 220.3a requires that certain information regarding the awarding of public work contracts, be furnished to the Commissioner of Labor. One "Notice of Contract Award" (PW 16, which may be photocopied), **MUST** be completed for **EACH** prime contractor on the above referenced project.

Upon notifying the successful bidder(s) of this contract, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

Contractor Information
All information must be supplied

Federal Employer Identification Number: _____

Name: _____

Address: _____

_____

City: _____ State: _____ Zip: _____

Amount of Contract: $_____

Approximate Starting Date: ____/____/____

Approximate Completion Date: ____/____/____

Contract Type:
[ ] (01) General Construction
[ ] (02) Heating/Ventilation
[ ] (03) Electrical
[ ] (04) Plumbing
[ ] (05) Other : _____

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12226

Social Security Numbers on Certified Payrolls:

The Department of Labor is cognizant of the concerns of the potential for misuse or inadvertent disclosure of social security numbers. Identity theft is a growing problem and we are sympathetic to contractors' concern regarding inclusion of this information on payrolls if another identifier will suffice.

For these reasons, the substitution of the use of the last four digits of the social security number on certified payrolls submitted to contracting agencies on public work projects is now acceptable to the Department of Labor. This change does not affect the Department's ability to request and receive the entire social security number from employers during its public work/ prevailing wage investigations.

Construction Industry Fair Play Act: Required Posting for Labor Law Article 25-B § 861-d

Construction industry employers must post the "Construction Industry Fair Play Act" notice in a prominent and accessible place on the job site. Failure to post the notice can result in penalties of up to $1,500 for a first offense and up to $5,000 for a second offense. The posting is included as part of this wage schedule. Additional copies may be obtained from the NYS DOL website, https://dol.ny.gov/public-work-and-prevailing-wage
If you have any questions concerning the Fair Play Act, please call the State Labor Department toll-free at 1-866-435-1499 or email us at: dol.misclassified@labor.ny.gov .

Worker Notification: (Labor Law §220, paragraph a of subdivision 3-a)

Effective June 23, 2020

This provision is an addition to the existing wage rate law, Labor Law §220, paragraph a of subdivision 3-a. It requires contractors and subcontractors to provide written notice to all laborers, workers or mechanics of the *prevailing wage and supplement rate* for their particular job classification *on each pay stub**. It also requires contractors and subcontractors to *post a notice* at the beginning of the performance of every public work contract *on each job site* that includes the telephone number and address for the Department of Labor and a statement informing laborers, workers or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her job classification. The required notification will be provided with each wage schedule, may be downloaded from our website *www.labor.ny.gov* or be made available upon request by contacting the Bureau of Public Work at 518-457-5589. *In the event the required information will not fit on the pay stub, an accompanying sheet or attachment of the information will suffice.

(12.20)

To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND

Budget Policy & Reporting Manual

B-610

Public Work Enforcement Fund

effective date December 7, 2005

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1. Purpose and Scope:

This Item describes the Public Work Enforcement Fund (the Fund, PWEF) and its relevance to State agencies and public benefit corporations engaged in construction or reconstruction contracts, maintenance and repair, and announces the recently-enacted increase to the percentage of the dollar value of such contracts that must be deposited into the Fund. This item also describes the roles of the following entities with respect to the Fund:

- New York State Department of Labor (DOL),
- The Office of the State of Comptroller (OSC), and
- State agencies and public benefit corporations.

2. Background and Statutory References:

DOL uses the Fund to enforce the State's Labor Law as it relates to contracts for construction or reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law. State agencies and public benefit corporations participating in such contracts are required to make payments to the Fund.

Chapter 511 of the Laws of 1995 (as amended by Chapter 513 of the Laws of 1997, Chapter 655 of the Laws of 1999, Chapter 376 of the Laws of 2003 and Chapter 407 of the Laws of 2005) established the Fund.

3. Procedures and Agency Responsibilities:

The Fund is supported by transfers and deposits based on the value of contracts for construction and reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law, into which all State agencies and public benefit corporations enter.

Chapter 407 of the Laws of 2005 increased the amount required to be provided to this fund to .10 of one-percent of the total cost of each such contract, to be calculated at the time agencies or public benefit corporations enter into a new contract or if a contract is amended. The provisions of this bill became effective August 2, 2005.

To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND

OSC will report to DOL on all construction-related ("D") contracts approved during the month, including contract amendments, and then DOL will bill agencies the appropriate assessment monthly. An agency may then make a determination if any of the billed contracts are exempt and so note on the bill submitted back to DOL. For any instance where an agency is unsure if a contract is or is not exempt, they can call the Bureau of Public Work at the number noted below for a determination. Payment by check or journal voucher is due to DOL within thirty days from the date of the billing. DOL will verify the amounts and forward them to OSC for processing.

For those contracts which are not approved or administered by the Comptroller, monthly reports and payments for deposit into the Public Work Enforcement Fund must be provided to the Administrative Finance Bureau at the DOL within 30 days of the end of each month or on a payment schedule mutually agreed upon with DOL.

Reports should contain the following information:

- Name and billing address of State agency or public benefit corporation;
- State agency or public benefit corporation contact and phone number;
- Name and address of contractor receiving the award;
- Contract number and effective dates;
- Contract amount and PWEF assessment charge (if contract amount has been amended, reflect increase or decrease to original contract and the adjustment in the PWEF charge); and
- Brief description of the work to be performed under each contract.

Checks and Journal Vouchers, payable to the "New York State Department of Labor" should be sent to:

Department of Labor
Administrative Finance Bureau-PWEF Unit
Building 12, Room 464
State Office Campus
Albany, NY 12226

Any questions regarding billing should be directed to NYSDOL's Administrative Finance Bureau-PWEF Unit at (518) 457-3624 and any questions regarding Public Work Contracts should be directed to the Bureau of Public Work at (518) 457-5589.

NEW YORK STATE OF OPPORTUNITY. Department of Labor

Required Notice under Article 25-B of the Labor Law

Attention All Employees, Contractors and Subcontractors: You are Covered by the Construction Industry Fair Play Act

The law says that you are an employee unless:

- You are free from direction and control in performing your job, **and**
- You perform work that is not part of the usual work done by the business that hired you, **and**
- You have an independently established business.

Your employer cannot consider you to be an independent contractor unless all three of these facts apply to your work.

It is against the law for an employer to misclassify employees as independent contractors or pay employees off the books.

Employee Rights: If you are an employee, you are entitled to state and federal worker protections. These include:

- Unemployment Insurance benefits, if you are unemployed through no fault of your own, able to work, and otherwise qualified,
- Workers' compensation benefits for on-the-job injuries,
- Payment for wages earned, minimum wage, and overtime (under certain conditions),
- Prevailing wages on public work projects,
- The provisions of the National Labor Relations Act, and
- A safe work environment.

It is a violation of this law for employers to retaliate against anyone who asserts their rights under the law. Retaliation subjects an employer to civil penalties, a private lawsuit or both.

Independent Contractors: If you are an independent contractor**, you must pay all taxes and Unemployment Insurance contributions required by New York State and Federal Law.**

Penalties for paying workers off the books or improperly treating employees as independent contractors:

- **Civil Penalty** — First offense: Up to $2,500 per employee

  Subsequent offense(s): Up to $5,000 per employee

- **Criminal Penalty** — First offense: Misdemeanor - up to 30 days in jail, up to a $25,000 fine and debarment from performing public work for up to one year.

  Subsequent offense(s): Misdemeanor - up to 60 days in jail or up to a $50,000 fine and debarment from performing public work for up to 5 years.

If you have questions about your employment status or believe that your employer may have violated your rights and you want to file a complaint, call the Department of Labor at (866) 435-1499 or send an email to dol.misclassified@labor.ny.gov. All complaints of fraud and violations are taken seriously. You can remain anonymous.

Employer Name:

IA 999 (09/16)

WE ARE YOUR DOL

NEW YORK STATE Department of Labor

New York State Department of Labor
Bureau of Public Work

Attention Employees

THIS IS A:

PUBLIC WORK PROJECT

If you are employed on this project as a **worker, laborer, or mechanic** you are entitled to receive the **prevailing wage and supplements rate** for the classification at which you are working.

Your pay stub and wage notice received upon hire must clearly state your wage rate and supplement rate.

Chapter 629 of the Labor Laws of 2007:

These wages are set by law and must be posted at the work site. They can also be found at: https://dol.ny.gov/bureau-public-work

If you feel that you have not received proper wages or benefits, please call our nearest office.*

Albany	(518) 457-2744	Patchogue	(631) 687-4882
Binghamton	(607) 721-8005	Rochester	(585) 258-4505
Buffalo	(716) 847-7159	Syracuse	(315) 428-4056
Garden City	(516) 228-3915	Utica	(315) 793-2314
New York City	(212) 932-2419	White Plains	(914) 997-9507
Newburgh	(845) 568-5287		

* For New York City government agency construction projects, please contact the Office of the NYC Comptroller at (212) 669-4443, or www.comptroller.nyc.gov – click on Bureau of Labor Law.

Contractor Name: _____

Project Location: _____

Requirements for OSHA 10 Compliance

Article 8 §220-h requires that when the advertised specifications, for every contract for public work, is $250,000.00 or more the contract must contain a provision requiring that every worker employed in the performance of a public work contract shall be certified as having completed an OSHA 10 safety training course. The clear intent of this provision is to require that all employees of public work contractors, required to be paid prevailing rates, receive such training “prior to the performing any work on the project.”

The Bureau will enforce the statute as follows:

All contractors and sub contractors must attach a copy of proof of completion of the OSHA 10 course to the first certified payroll submitted to the contracting agency and on each succeeding payroll where any new or additional employee is first listed.

Proof of completion may include but is not limited to:

- Copies of bona fide course completion card (*Note: Completion cards do not have an expiration date.)*
- Training roster, attendance record of other documentation from the certified trainer pending the issuance of the card.
- Other valid proof

**A certification by the employer attesting that all employees have completed such a course is not sufficient proof that the course has been completed.

Any questions regarding this statute may be directed to the New York State Department of Labor, Bureau of Public Work at 518-457-5589.

WICKS

Public work projects are subject to the Wicks Law requiring separate specifications and bidding for the plumbing, heating and electrical work, when the total project's threshold is $3 million in Bronx, Kings, New York, Queens and, Richmond counties; $1.5 million in Nassau, Suffolk and Westchester counties; and $500,000 in all other counties.

For projects below the monetary threshold, bidders must submit a sealed list naming each subcontractor for the plumbing, HVAC and electrical and the amount to be paid to each. The list may not be changed unless the public owner finds a legitimate construction need, including a change in specifications or costs or the use of a Project Labor Agreement (PLA), and must be open to public inspection.

Allows the state and local agencies and authorities to waive the Wicks Law and use a PLA if it will provide the best work at the lowest possible price. If a PLA is used, all contractors shall participate in apprentice training programs in the trades of work it employs that have been approved by the Department of Labor (DOL) for not less than three years. They shall also have at least one graduate in the last three years and use affirmative efforts to retain minority apprentices. PLA's would be exempt from Wicks, but deemed to be public work subject to prevailing wage enforcement.

The Commissioner of Labor shall have the power to enforce separate specification requirement s on projects, and may issue stop-bid orders against public owners for non-compliance.

Other new monetary thresholds, and similar sealed bidding for non-Wicks projects, would apply to certain public authorities including municipal housing authorities, NYC Construction Fund, Yonkers Educational Construction Fund, NYC Municipal Water Finance Authority, Buffalo Municipal Water Finance Authority, Westchester County Health Care Association, Nassau County Health Care Corp., Clifton-Fine Health Care Corp., Erie County Medical Center Corp., NYC Solid Waste Management Facilities, and the Dormitory Authority.

Contractors must pay subcontractors within a 7 days period.

(07.19)

Introduction to the Prevailing Rate Schedule

Information About Prevailing Rate Schedule

This information is provided to assist you in the interpretation of particular requirements for each classification of worker contained in the attached Schedule of Prevailing Rates.

Classification

It is the duty of the Commissioner of Labor to make the proper classification of workers taking into account whether the work is heavy and highway, building, sewer and water, tunnel work, or residential, and to make a determination of wages and supplements to be paid or provided. It is the responsibility of the public work contractor to use the proper rate. If there is a question on the proper classification to be used, please call the district office located nearest the project. District office locations and phone numbers are listed below.

Prevailing Wage Schedules are issued separately for "General Construction Projects" and "Residential Construction Projects" on a county-by-county basis.

General Construction Rates apply to projects such as: Buildings, Heavy & Highway, and Tunnel and Water & Sewer rates.

Residential Construction Rates generally apply to construction, reconstruction, repair, alteration, or demolition of one family, two family, row housing, or rental type units intended for residential use.

Some rates listed in the Residential Construction Rate Schedule have a very limited applicability listed along with the rate. Rates for occupations or locations not shown on the residential schedule must be obtained from the General Construction Rate Schedule. Please contact the local Bureau of Public Work office before using Residential Rate Schedules, to ensure that the project meets the required criteria.

Payrolls and Payroll Records

Contractors and subcontractors are required to establish, maintain, and preserve for not less that six (6) years, contemporaneous, true, and accurate payroll records.

Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury.

Paid Holidays

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

Overtime

At a minimum, all work performed on a public work project in excess of eight hours in any one day or more than five days in any workweek is overtime. However, the specific overtime requirements for each trade or occupation on a public work project may differ. Specific overtime requirements for each trade or occupation are contained in the prevailing rate schedules.

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays.

The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Supplemental Benefits

Particular attention should be given to the supplemental benefit requirements. Although in most cases the payment or provision of supplements is straight time for all hours worked, some classifications require the payment or provision of supplements, or a portion of the supplements, to be paid or provided at a premium rate for premium hours worked. Supplements may also be required to be paid or provided on paid holidays, regardless of whether the day is worked. The Overtime Codes and Notes listed on the particular wage classification will indicate these conditions as required.

Effective Dates

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. The rate listed is valid until the next effective rate change or until the new annual determination which takes effect on July 1 of each year. All contractors and subcontractors are required to pay the current prevailing rates of wages and supplements. If you have any questions please contact the Bureau of Public Work or visit the New York State Department of Labor website (www.labor.ny.gov) for current wage rate information.

Apprentice Training Ratios

The following are the allowable ratios of registered Apprentices to Journey-workers.

For example, the ratio 1:1,1:3 indicates the allowable initial ratio is one Apprentice to one Journeyworker. The Journeyworker must be in place on the project before an Apprentice is allowed. Then three additional Journeyworkers are needed before a second Apprentice is allowed. The last ratio repeats indefinitely. Therefore, three more Journeyworkers must be present before a third Apprentice can be hired, and so on.

Please call Apprentice Training Central Office at (518) 457-6820 if you have any questions.

Title (Trade)	Ratio
Boilermaker (Construction)	1:1,1:4
Boilermaker (Shop)	1:1,1:3
Carpenter (Bldg.,H&H, Pile Driver/Dockbuilder)	1:1,1:4
Carpenter (Residential)	1:1,1:3
Electrical (Outside) Lineman	1:1,1:2
Electrician (Inside)	1:1,1:3
Elevator/Escalator Construction & Modernizer	1:1,1:2
Glazier	1:1,1:3
Insulation & Asbestos Worker	1:1,1:3
Iron Worker	1:1,1:4
Laborer	1:1,1:3
Mason	1:1,1:4
Millwright	1:1,1:4
Op Engineer	1:1,1:5
Painter	1:1,1:3
Plumber & Steamfitter	1:1,1:3
Roofer	1:1,1:2
Sheet Metal Worker	1:1,1:3
Sprinkler Fitter	1:1,1:2

If you have any questions concerning the attached schedule or would like additional information, please contact the nearest BUREAU of PUBLIC WORK District Office or write to:

New York State Department of Labor
Bureau of Public Work
State Office Campus, Bldg. 12
Albany, NY 12226

District Office Locations:	Telephone #	FAX #
Bureau of Public Work - Albany	518-457-2744	518-485-0240
Bureau of Public Work - Binghamton	607-721-8005	607-721-8004
Bureau of Public Work - Buffalo	716-847-7159	716-847-7650
Bureau of Public Work - Garden City	516-228-3915	516-794-3518
Bureau of Public Work - Newburgh	845-568-5287	845-568-5332
Bureau of Public Work - New York City	212-932-2419	212-775-3579
Bureau of Public Work - Patchogue	631-687-4882	631-687-4902
Bureau of Public Work - Rochester	585-258-4505	585-258-4708
Bureau of Public Work - Syracuse	315-428-4056	315-428-4671
Bureau of Public Work - Utica	315-793-2314	315-793-2514
Bureau of Public Work - White Plains	914-997-9507	914-997-9523
Bureau of Public Work - Central Office	518-457-5589	518-485-1870

Orange County General Construction

Boilermaker — 02/01/2024

JOB DESCRIPTION Boilermaker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES

Per Hour:	07/01/2023	01/01/2024
Boilermaker	$ 65.88	$ 67.38
Repairs & Renovations	65.88	67.38

Repairs & Renovation: Includes Repairing, Renovating replacement of parts to an existing unit(s).

SUPPLEMENTAL BENEFITS
Per Hour:

Boilermaker	33.5% of hourly Wage Paid	33.5% of Hourly Wage Paid
Repair $ Renovations	+ $ 26.49	+ $26.85

NOTE: "Hourly Wage Paid" shall include any and all premium(s) pay.

Repairs & Renovation Includes replacement of parts and repairs & renovation of existing unit.

OVERTIME PAY
See (*B, O, **U) on OVERTIME PAGE
Note:* Includes 9th & 10th hours, double for 11th or more.
** Labor Day ONLY, if worked.

Repairs & Renovation see (B,E,Q) on OT Page

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 12, 15, 25, 26, 29) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage per hour:
(1/2) Year Terms at the following percentage of Boilermaker's Wage

1st	2nd	3rd	4th	5th	6th	7th
65%	70%	75%	80%	85%	90%	95%

Supplemental Benefits Per Hour:

Apprentice(s)	33.5% of Hourly Wage Paid Plus Amount Below	33.5% of Hourly Wage Paid Plus Amount Below
1st Term	$ 20.12	$ 20.36
2nd Term	21.03	21.28
3rd Term	21.95	22.22
4th Term	22.83	23.12
5th Term	23.76	24.07
6th Term	24.67	25.00
7th Term	25.58	25.93

NOTE: "Hourly Wage Paid" shall include any and all premium(s)

4-5

Carpenter — 02/01/2024

JOB DESCRIPTION Carpenter **DISTRICT** 8

ENTIRE COUNTIES
Dutchess, Orange

WAGES
Per hour: 07/01/2023

Building:
Millwright $ 46.00
+ 8.17*

*This portion is not subject to overtime premiums

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman $ 34.31

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (18,19) on HOLIDAY PAGE.
Paid: See (5,6,11,13,16,18,19,25) for 1st & 2nd yr.Apprentices
Overtime: See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wages per hour:

One (1) year terms:

1st	2nd	3rd	4th
$28.01	$30.34	$34.67	$43.33
+ 4.27*	+ 5.06*	+ 5.81*	+ 7.31*

*This portion is not subject to overtime premiums

Supplemental benefits per hour:

1st	2nd	3rd	4th
$22.55	$24.34	$26.45	$29.18

8-740.2

Carpenter **02/01/2024**

JOB DESCRIPTION Carpenter **DISTRICT** 8

ENTIRE COUNTIES
Dutchess

PARTIAL COUNTIES
Orange: : The territory west demarcated by a line drawn from the Bear Mountain Bridge continuing east to the Bear Mountain Circle. The territory south demarcated by a line continuing north on 9W to the town of Cornwall where County Road 107 (also known as Quaker Rd) crosses under 9W to the centerline of Route 32, The territories south and east heading north on Route 32 to Orrs Mills Rd, then west on Orrs Mills Rd to Route 94, continue west and south on Route 94 to the Town of Chester, to the intersection of Kings Highway, continue south on Kings Highway to Bellvale Rd, west on Bellvale Rd to Bellvale Lakes Rd, then south on Bellvale Lakes Rd to Kain Rd, southeast on Kain Rd to Route 17A, then north and southeast along Route 17A to Route 210, then follow Route 210 to NJ Border.

WAGES
Per hour: 07/01/2023

Carpet/Resilient
Floor Coverer $ 34.45
+ 3.25*

*This portion is not subject to overtime premiums

INCLUDES HANDLING & INSTALLATION OF ARTIFICIAL TURF AND SIMILAR TURF INDOORS/OUTDOORS.

SUPPLEMENTAL BENEFITS
Per hour:
$ 28.33

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (18, 19) on HOLIDAY PAGE
Paid for 1st & 2nd yr.
Apprentices: See (5, 6, 11, 13, 16, 18, 19, 25)

Overtime: See (5, 6, 11, 13, 16, 18, 19, 25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wage per hour - (1) year terms:

1st	2nd	3rd	4th
$15.75	$18.87	$23.55	$28.23
+ 2.48*	+ 2.48*	+ 2.48*	+ 2.48*

*This portion is not subject to overtime premiums

Supplemental Benefits per hour - All apprentice terms:

$ 20.87

8-2287D&O

Carpenter — 02/01/2024

JOB DESCRIPTION Carpenter **DISTRICT** 8

ENTIRE COUNTIES

Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per Hour: 07/01/2023

Marine Construction:

Marine Diver	$ 74.03
	+ 9.79*
Marine Tender	$ 53.57
	+ 9.79*

*This portion is not subject to overtime premiums

SUPPLEMENTAL BENEFITS

Per Hour:

Journeyworker	$ 45.34

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (18, 19) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 13, 16, 18, 19, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour:
One (1) year terms.

1st year	$ 25.60
	+ 5.30*
2nd year	31.20
	+ 5.30*
3rd year	39.58
	+ 5.30*
4th year	47.97
	+ 5.05*

*This portion is not subject to overtime premiums

Supplemental Benefits
Per Hour:

All terms	$ 31.83

8-1456MC

Carpenter — 02/01/2024

JOB DESCRIPTION Carpenter **DISTRICT** 8

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Westchester

PARTIAL COUNTIES
Orange: South of but including the following, Waterloo Mills, Slate Hill, New Hampton, Goshen, Blooming Grove, Mountainville, east to the Hudson River.
Putnam: South of but including the following, Cold Spring, TompkinsCorner, Mahopac, Croton Falls, east to Connecticut border.
Suffolk: West of Port Jefferson and Patchogue Road to Route 112 to the Atlantic Ocean.

WAGES

Per hour:	07/01/2023
Core Drilling:	
Driller	$ 43.88 + 2.50*
Driller Helper	$ 34.47 + 2.50*

Note: Hazardous Waste Pay Differential:
For Level C, an additional 15% above wage rate per hour
For Level B, an additional 15% above wage rate per hour
For Level A, an additional 15% above wage rate per hour
Note: When required to work on water: an additional $ 3.00 per hour.

*This portion is not subject to overtime premiums

SUPPLEMENTAL BENEFITS

Per hour:	
Driller and Helper	$ 28.85

OVERTIME PAY
See (B, G, P) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

8-1536-CoreDriller

Carpenter - Building / Heavy&Highway — 02/01/2024

JOB DESCRIPTION Carpenter - Building / Heavy&Highway **DISTRICT** 2

ENTIRE COUNTIES
Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Wyoming, Yates

PARTIAL COUNTIES
Orange: The area lying on Northern side of Orange County demarcated by a line drawn from the Bear Mountain Bridge continuing west to the Bear Mountain Circle, continue North on 9W to the town of Cornwall where County Road 107 (also known as Quaker Rd) crosses under 9W, then east on County Road 107 to Route 32, then north on Route 32 to Orrs Mills Rd, then west on Orrs Mills Rd to Route 94, continue west and south on Route 94 to the Town of Chester, to the intersection of Kings Highway, continue south on Kings Highway to Bellvale Rd, west on Bellvale Rd to Bellvale Lakes Rd, then south on Bellvale Lakes Rd to Kain Rd, southeast on Kain Rd to Route 17A, then north and southeast along Route 17A to Route 210, then follow Route 210 to NJ Border.

WAGES

Wages per hour:	07/01/2023	07/01/2024 Additional
Carpenter - ONLY for Artificial Turf/Synthetic Sport Surface	$ 34.48	$ 2.25*

*To be allocated at a later date
Note - Does not include the operation of equipment. Please see Operating Engineers rates.

SUPPLEMENTAL BENEFITS

Per hour:	
Journeyman	$ 26.30

OVERTIME PAY
See (B, E, Q, X) on OVERTIME PAGE

HOLIDAY
Paid: See (5) on HOLIDAY PAGE

Overtime: See (5, 6, 16) on HOLIDAY PAGE
Notes:
When a holiday falls upon a Saturday, it shall be observed on the preceding Friday. Whan a holiday falls upon a Sunday, it shall be observed on the following Monday.
An employee taking an unexcused day off the regularly scheduled day before or after a paid Holiday shall not receive Holiday pay.

REGISTERED APPRENTICES
Wages per hour (1300 hour terms at the following percentage of Journeyman's wage):

1st	2nd	3rd	4th
65%	70%	75%	80%

Supplemental Benefits per hour:

1st term	$ 17.56
2nd term	18.04
3rd term	20.06
4th term	20.54

2-42AtSS

Carpenter - Building / Heavy&Highway — 02/01/2024

JOB DESCRIPTION Carpenter - Building / Heavy&Highway **DISTRICT** 11

ENTIRE COUNTIES
Columbia, Dutchess, Orange, Sullivan, Ulster

WAGES
WAGES (per hour)

Applies to Carpenter (Building/Heavy & Highway/Tunnel), Dockbuilder, Piledriver, Dive Tender, and Diver (Dry):

	07/01/2023	07/01/2024 Additional	07/01/2025 Additional	07/01/2026 Additional
Base Wage	$ 35.81 + 4.88*	$ 2.16**	$ 2.23**	$ 2.30**

Applies to Diver (Wet):

Base Wage	$ 50.00 + 4.88*

*For all hours paid straight or premium.
**To be allocated at a later date.

SHIFT DIFFERENTIAL: When mandated by a Government Agency irregular or off shift can be worked. The Carpenter shall receive an additional fifteen percent (15%) of the base wage.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 31.30

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
BUILDING:
Paid: See (1) on HOLIDAY PAGE.
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE.
- Holidays that fall on Sunday will be observed Monday.

HEAVY&HIGHWAY/TUNNEL:
Paid: See (5, 6, 25) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
- Holidays that fall on Sunday will be observed Monday
- Must be employed during the five (5) work days immediately preceding a holiday or during the five (5) work days following the paid holiday to receive holiday pay
- If Employee is entitled to a paid holiday, the Employee is paid the Holiday wage and supplemental benefits whether they work or not. If Employee works the Holiday, the Employee will receive holiday pay (including supplemental benefits), plus the applicable premium wage for working the Holiday. If Employee works in excess of 8 hours on Holiday, then benefits will be paid for any hours in excess of 8 hours.

REGISTERED APPRENTICES
1 Year terms at the following wage rates.

1st	2nd	3rd	4th	5th

$ 17.91	$ 21.49	$ 23.28	$ 25.07	$ 28.65
+2.58*	+2.58*	+2.58*	+2.58*	+2.58*

*For all hours paid straight or premium

SUPPLEMENTAL BENEFITS per hour:

All Terms $ 16.32

11-279.2B/H&H

Carpenter - Floor Coverer 02/01/2024

JOB DESCRIPTION Carpenter - Floor Coverer **DISTRICT** 11

ENTIRE COUNTIES
Columbia, Sullivan, Ulster

PARTIAL COUNTIES
Orange: The area lying on Northern side of Orange County demarcated by a line drawn from the Bear Mountain Bridge continuing west to the Bear Mountain Circle, continue North on 9W to the town of Cornwall where County Road 107 (also known as Quaker Rd) crosses under 9W, then east on County Road 107 to Route 32, then north on Route 32 to Orrs Mills Rd, then west on Orrs Mills Rd to Route 94, continue west and south on Route 94 to the Town of Chester, to the intersection of Kings Highway, continue south on Kings Highway to Bellvale Rd, west on Bellvale Rd to Bellvale Lakes Rd, then south on Bellvale Lakes Rd to Kain Rd, southeast on Kain Rd to Route 17A, then north and southeast along Route 17A to Route 210, then follow Route 210 to NJ Border.

WAGES
WAGES:(per hour)

	07/01/2023	07/01/2024 Additional	07/01/2025 Additional
Carpet/Resilient Floor Coverer	$ 35.81 +4.88*	$ 2.16**	$ 2.23**

* For all hours paid straight or premium
** To be allocated at a later date.

SHIFT DIFFERENTIAL: When mandated by a Government Agency irregular or off shift can be worked. The Carpenter shall receive an additional fifteen (15) percent of wage plus applicable benefits.

SUPPLEMENTAL BENEFITS
Per hour:

Journey worker $ 31.30

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
BUILDING:
Paid: See (1) on HOLIDAY PAGE.
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE.
- Holidays that fall on Sunday will be observed Monday.

HEAVY&HIGHWAY/TUNNEL:
Paid: See (5, 6, 25) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
- Holidays that fall on Sunday will be observed Monday
- Must be employed during the five (5) work days immediately preceding a holiday or during the five (5) work days following the paid holiday to receive holiday pay
- If Employee is entitled to a paid holiday, the Employee is paid the Holiday wage and supplemental benefits whether they work or not. If Employee works the Holiday, the Employee will receive holiday pay (including supplemental benefits), plus the applicable premium wage for working the Holiday. If Employee works in excess of 8 hours on Holiday, then benefits will be paid for any hours in excess of 8 hours.

REGISTERED APPRENTICES
1 Year terms at the following wage rates.

1st	2nd	3rd	4th	5th
$ 17.91	$ 21.49	$ 23.28	$ 25.07	$ 28.65
+2.58*	+2.58*	+2.58*	+2.58*	+2.58*

*For all hours paid straight or premium

SUPPLEMENTAL BENEFITS per hour:

All terms $ 16.32

11-279.2Floor

Electrician 02/01/2024

JOB DESCRIPTION Electrician **DISTRICT** 11

ENTIRE COUNTIES
Orange, Putnam, Rockland

PARTIAL COUNTIES
Dutchess: Towns of Fishkill, East Fishkill, and Beacon.

WAGES
Per hour:

	07/01/2023	04/01/2024
Electrician Wireman/Technician	$ 49.50	$ 50.50
	+9.00*	+ 9.50*

SHIFT DIFFERENTIAL: On Public Work in New York State when shift work is mandated either in the job specifications or by the contracting agency, the following rates apply when shift is worked:

Between 4:30pm & 12:30am	$ 58.08	$ 59.30
	+ 9.00*	+ 9.50*
Between 12:30am & 8:30am	$ 65.06	$66.35
	+ 9.00*	+ 9.50*

*For all hours paid straight or premium, not to be included in 3% calculation for supplemental benefits.

NOTE ADDITIONAL AMOUNTS PAID FOR THE FOLLOWING WORK LISTED BELOW (subject to overtime premiums):
- On jobs where employees are required to work from boatswain chairs, swinging scaffolds, etc., forty (40) feet or more above the ground, or under compressed air, using Scottair packs, or gas masks, they shall receive an additional $2.00 per hour above the regular straight time rate.
- Journeyman Wireman working in Shafts, Tunnels or on Barges: $5.00 above the Journeyman Wireman rate of pay
- Journeyman Wireman when performing welding or cable splicing: $3.00 above the Journeyman Wireman rate of pay
- Journeyman Wireman required to have a NYS Asbestos Certificate: $3.00 above the Journeyman Wireman rate of pay
- Journeyman Wireman required to have a CDL: $3.00 above the Journeyman Wireman rate of pay.

SUPPLEMENTAL BENEFITS

Per hour:	07/01/2023	04/01/2024
Journeyman	$ 28.68 plus 3% of straight or premium wage	$ 29.68 plus 3% of straight or premium wage

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 13, 15, 16, 25) on HOLIDAY PAGE
When the holiday falls on a Saturday it is observed the Friday before. When the holiday falls on a Sunday it is observed on the Monday after.

REGISTERED APPRENTICES
WAGES:
(1)year terms at the following rates

07/01/2023	1st	2nd	3rd	4th	5th	6th
1st Shift	$ 14.25	$ 19.00	$ 23.75	$ 28.50	$ 33.25	$ 35.63
	+1.00*	+1.00*	+1.50*	+2.00*	+2.50*	+2.50*
2nd Shift	16.72	22.29	27.86	33.43	39.00	41.79
	+1.00*	+1.00*	+1.50*	+2.00*	+2.50*	+2.50*
3rd Shift	18.72	24.97	31.21	37.45	43.69	46.82
	+1.00*	+1.00*	+1.50*	+2.00*	+2.50*	+2.50*

09/01/2023	1st	2nd	3rd	4th	5th	6th
1st Shift	$ 15.68	$ 19.00	$ 23.75	$ 28.50	$ 33.25	$ 35.63
	+1.00*	+1.00*	+1.50*	+2.00*	+2.50*	+2.50*
2nd Shift	18.39	22.29	27.86	33.43	39.00	41.79
	+1.00*	+1.00*	+1.50*	+2.00*	+2.50*	+2.50*
3rd Shift	20.60	24.97	31.21	47.45	43.69	46.82
	+1.00*	+1.00*	+1.50*	+2.00*	+2.50*	+2.50*

04/01/2024	1st	2nd	3rd	4th	5th	6th
1st Shift	$ 16.01	$ 19.40	$ 24.25	$ 29.10	$ 33.95	$ 36.38
	+1.00*	+1.00*	+1.50*	+2.00*	+2.50*	+2.50*

2nd Shift	18.78	22.76	28.45	34.13	39.82	42.67
	+1.00*	+1.00*	+1.50*	+2.00*	+2.50*	+2.50*
3rd Shift	21.04	25.49	31.86	38.24	44.61	47.80
	+1.00*	+1.00*	+1.50*	+2.00*	+2.50*	+2.50*

09/01/2024	1st	2nd	3rd	4th	5th	6th
1st Shift	$ 16.01	$ 19.40	$ 24.25	$ 29.10	$ 33.95	$ 36.38
	+1.00*	+1.00*	+1.00*	+2.00*	+2.50*	+2.50*
2nd Shift	18.78	22.76	28.45	34.13	39.82	42.67
	+1.00*	+1.00*	+1.00*	+2.00*	+2.50*	+2.50*
3rd Shift	21.04	25.49	31.86	38.24	44.61	47.80
	+1.00*	+1.00*	+1.00*	+2.00*	+2.50*	+2.50*

04/01/2025	1st	2nd	3rd	4th	5th	6th
1st Shift	$ 16.34	$ 19.80	$ 24.75	$ 29.70	$ 34.65	$ 37.13
	+1.00*	+1.00*	+1.00*	+2.00*	+2.50*	+2.50*
2nd Shift	19.17	23.23	29.03	34.84	40.64	43.55
	+1.00*	+1.00*	+1.00*	+2.00*	+2.50*	+2.50*
3rd Shift	21.47	26.02	32.52	39.03	45.53	48.79
	+1.00*	+1.00*	+1.00*	+2.00*	+2.50*	+2.50*

*For all hours paid straight or premium, not to be included in 3% calculation for supplemental benefits.

SUPPLEMENTAL BENEFITS per hour:

07/01/2023	
1st term	$ 16.28 plus 3% of straight or premium wage
2nd term	$ 16.28 plus 3% of straight or premium wage
3rd term	$ 18.28 plus 3% of straight or premium wage
4th term	$ 18.78 plus 3% of straight or premium wage
5th term	$ 20.28 plus 3% of straight or premium wage
6th term	$ 20.28 plus 3% of straight or premium wage

09/01/2024	
1st term	$ 16.28 plus 3% of straight or premium wage
2nd term	$ 17.78 plus 3% of straight or premium wage
3rd term	$ 18.78 plus 3% of straight or premium wage
4th term	$ 19.78 plus 3% of straight or premium wage
5th term	$ 21.28 plus 3% of straight or premium wage
6th term	$ 21.28 plus 3% of straight or premium wage

11-363/1

Elevator Constructor — 02/01/2024

JOB DESCRIPTION Elevator Constructor **DISTRICT** 1

ENTIRE COUNTIES
Columbia, Dutchess, Greene, Orange, Putnam, Sullivan, Ulster

PARTIAL COUNTIES
Delaware: Towns of Andes, Bovina, Colchester, Davenport, Delhi, Harpersfield, Hemdon, Kortright, Meredith, Middletown, Roxbury, Hancock & Stamford
Rockland: Only the Township of Stony Point.
Westchester: Only the Townships of Bedford, Lewisboro, Cortland, Mt. Kisco, North Salem, Pound Ridge, Somers and Yorktown.

WAGES

Per Hour	07/01/2023	01/01/2024
Mechanic	$ 67.35	$ 70.15
Helper	70% of Mechanic Wage Rate	70% of Mechanic Wage Rate

NOTE - The "Employer Registration" (30.1) use of a '4 Day/10 Hour Work schedules' will no longer be accepted or processed. All registered projects prior to June 30, 2023 will expire within the granted time frame.

For Pre-Registered Projects Four (4), Ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day. Tuesday thru Friday may be worked with no make-up day. For further clarification contact your local Bureau Office.

SUPPLEMENTAL BENEFITS

Per hour

	07/01/2023	01/01/2024
Journeyperson/Helper	$ 37.335*	$ 37.885*

(*)Plus 6% of regular hourly if less than 5 years of service. Plus 8% of regular hourly rate if more than 5 years of service.

OVERTIME PAY
See (D, O) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 15, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 15, 16) on HOLIDAY PAGE
Note: When a paid holiday falls on Saturday, it shall be observed on Friday. When a paid holiday falls on Sunday, it shall be observed on Monday.

REGISTERED APPRENTICES
Wages per hour:

0-6 mo*	6-12 mo	2nd yr	3rd yr	4th yr
50 %	55 %	65 %	70 %	80 %

(*)Plus 6% of the hourly rate, no additional supplemental benefits.

Supplemental Benefits per hour worked:

Same as Journeyperson/Helper

1-138

Glazier — 02/01/2024

JOB DESCRIPTION Glazier **DISTRICT** 8

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES
Per hour: 7/01/2023

Glazier & Glass Tinting	$ 61.64
*Scaffolding	65.64
Window Film	
**Repair & Maintenance	30.76

*Scaffolding includes swing scaffold, mechanical equipment, scissor jacks, man lifts, booms & buckets 30' or more, but not pipe scaffolding.

**Repair & Maintenance- All repair & maintenance work on a particular building whenever performed, where the total cumulative Repair & Maintenance contract value is under $184,000.

SUPPLEMENTAL BENEFITS
Per hour: 7/01/2023

Glazier & Glass Tinting	$ 40.20
Window Film	
Repair & Maintenance	23.19

OVERTIME PAY
See (B, E, Q, V) on OVERTIME PAGE
For 'Repair & Maintenance' see (B, B2, I, S) on overtime page.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (4, 6, 16, 25) on HOLIDAY PAGE
For 'Repair & Maintenance'
Paid: See(5, 6, 16, 25)
Overtime: See(5, 6, 16, 25)

REGISTERED APPRENTICES
Wage per hour:
(1) year terms at the following wage rates:
7/01/2023

1st term	$ 21.93
2nd term	30.05
3rd term	39.95
4th term	48.97

Supplemental Benefits:
(Per hour)

1st term	$ 18.25
2nd term	25.97
3rd term	31.27
4th term	34.32

8-1087 (DC9 NYC)

Insulator - Heat & Frost — 02/01/2024

JOB DESCRIPTION Insulator - Heat & Frost **DISTRICT** 8

ENTIRE COUNTIES
Dutchess, Orange, Putnam, Rockland, Westchester

WAGES

Per hour:	07/01/2023	06/01/2024
Insulator	$ 59.25	+ $ 2.50
Discomfort & Additional Training**	62.31	+ $ 2.50
Fire Stop Work*	31.77	+ $ 2.50

* Applies on all exclusive Fire Stop Work (When contract is for Fire Stop work only). No apprentices on these contracts only.

**Applies to work requiring; garb or equipment worn against the body not customarily worn by insulators; psychological evaluation ;special training, including but not limited to "Yellow Badge" radiation training

Note: Additional $0.50 per hour for work 30 feet or more above floor or ground level.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyworker	$ 37.35
Discomfort & Additional Training	39.39
Fire Stop Work:	
Journeyworker	19.03

OVERTIME PAY
See (B, E, E2, Q, *T) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Note: Last working day preceding Christmas and New Years day, workers shall work no later than 12:00 noon and shall receive 8 hrs pay.

Overtime: See (2*, 4, 6, 16, 25) on HOLIDAY PAGE.
*Note: Labor Day triple time if worked.

REGISTERED APPRENTICES
(1) year terms:

Insulator Apprentices:

1st	2nd	3rd	4th
$ 31.77	$ 37.26	$ 42.76	$ 48.26

Discomfort & Additional Training Apprentices:

1st	2nd	3rd	4th
$ 33.30	$ 39.09	$ 44.90	$ 50.71

Supplemental Benefits paid per hour:

Insulator Apprentices:

1st term	$ 19.03
2nd term	22.69
3rd term	26.36
4th term	30.03

Discomfort & Additional Training Apprentices:

1st term	$ 20.06
2nd term	23.92
3rd term	27.78
4th term	31.66

8-91

Ironworker — 02/01/2024

JOB DESCRIPTION Ironworker **DISTRICT** 11

ENTIRE COUNTIES
Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster

WAGES
Per hour:

	07/01/2023	07/01/2024 Additional	07/01/2025 Additional	07/01/2026 Additional
Structural	$ 52.63	$ 2.00*	$ 2.00*	$2.00*
Reinforcing*	52.63	2.00*	2.00*	2.00*
Ornamental	52.63	2.00*	2.00*	2.00*
Chain Link Fence	52.63	2.00*	2.00*	2.00*

* To be allocated at a later date.

NOTE: For Reinforcing classification ONLY, Ironworker 4-46Reinf rates apply in Rockland County's southern section (south of Convent Road and east of Blue Hills Road).

On Government Mandated Irregular Work Days or Shift Work, the following wage will be paid:

1st Shift	$ 52.63
2nd Shift	67.34
3rd Shift	72.24

**Note- Any shift that works past 12:00 midnight shall receive the 3rd shift differential.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 43.47

OVERTIME PAY
See (B1, Q, V) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16) on HOLIDAY PAGE
If a holiday falls on Saturday, it will be observed Friday. If a holiday falls on Sunday, it will be observed Monday.

REGISTERED APPRENTICES
Wages:

(1) year terms at the following wage:

	1st yr	2nd yr	3rd yr	4th yr
1st Shift	$ 26.32	$ 31.58	$ 36.85	$ 42.10
2nd Shift	36.16	42.40	48.64	54.86
3rd Shift	39.45	46.00	52.57	59.12

Supplemental Benefits per hour:

1st year	$ 37.35
2nd year	38.57
3rd year	39.80
4th year	41.02

11-417

Laborer - Building — 02/01/2024

JOB DESCRIPTION Laborer - Building **DISTRICT** 11

ENTIRE COUNTIES
Orange, Sullivan, Ulster

PARTIAL COUNTIES
Delaware: Only the Townships of Andes, Bovina, Davenport, Delhi, Franklin, Hamden, Harpersfield, Kortright, Meredith, Middletown, Roxbury, and Stamford.
Greene: Only the Township of Catskill.

WAGES
Class 1: Custodial and janitorial work, general cleanup, and flag person.

Class 2: Concrete laborer, mason tending, hod carrier, signal person, pressure blasting and washing, chainsaw, demo saw, jackhammers, general labor.

Class 3: Jumping jack, air track drills, grading, explosive handler and blaster, grade checker. When OSHA requires negative pressure respirator.

Class 4: Environmental work including but not limited to asbestos abatement, toxic and hazardous abatement, lead abatement work, mold remediation and biohazards.

WAGES: (per hour)	07/01/2023	06/01/2024	06/01/2025 Additional	06/01/2026 Additional
Class 1	$ 41.65	$ 43.15	$ 2.69*	$ 2.79*
Class 2	42.40	43.95	2.72*	2.82*
Class 3	44.30	45.90	2.79*	2.89*
Class 4	47.30	49.00	2.90*	3.00*

*To be allocated at a later date.

These rates will cover all work within five feet of the building foundation line.

Shift Differential: On all Governmental mandated irregular or off shift work, an additional 25% of wage is required. The 25% shift differential will be paid on public works contract for shifts or irregular workdays outside the normal working hours for 2nd and 3rd shifts or irregular work day or when mandated or required by state, federal, county, local or other governmental agency contracts.

SUPPLEMENTAL BENEFITS

Per hour:		
Journeyman	$ 32.40	$ 33.50
Shift	39.46	40.84

OVERTIME PAY
See (B, *E, E5, **Q) on OVERTIME PAGE
*For first 8 hours on Saturday
**When an employee is required to work on a holiday which falls on a Sunday the employee shall be paid three (3) times the hourly rate and one (1) hour benefits for every hour worked. When an employee is required to work on a holiday which falls on a Saturday the employee shall be paid two and a half (2.5) times the hourly rate and one hour benefits for every hour worked.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE
Holidays that fall on Saturday shall be observed on Friday, when holidays fall on Sunday they shall be observed on Monday.

REGISTERED APPRENTICES
(1000) hour terms at the following wages.

	07/01/2023	06/01/2024
1st term	$ 27.05	$ 28.05
2nd term	31.25	32.35
3rd term	35.40	36.70
4th term	39.55	41.00

Supplemental Benefits per hour:		
All Terms Regular	$ 28.33	$ 29.23
All Terms Shift Rate	34.27	TBD

11-17.BA

Laborer - Heavy&Highway — 02/01/2024

JOB DESCRIPTION Laborer - Heavy&Highway **DISTRICT** 11

ENTIRE COUNTIES
Orange, Sullivan, Ulster

PARTIAL COUNTIES

Delaware: Only the Townships of Andes, Bovina, Middletown, Roxbury,Franklin, Hamden, Stamford, Delhi, Kortright, Harpersfield,Meredith, and Davenport.
Greene: Only the Township of Catskill.

WAGES

CLASS 1: Flagperson, gateperson.

CLASS 2: General laborer, chuck tender, nipper, powder carrier, magazine tender, concrete men, vibrator men, mason tender, mortar men, traffic control, custodial work, temporary heat, pump men, pit men, dump men, asphalt men, joint setter, signalman, pipe men, riprap, dry stone layers, jack hammer, bush hammer, pavement breaker, men on mulching & seeding machines, all seeding & sod laying, landscape work, walk behind self-propelled power saws, grinder, walk behind rollers and tampers of all types, burner men, filling and wiring of baskets for gabion walls, chain saw operator, railroad track laborers, power buggy, plaster & acoustic pump, power brush cutter, retention liners, walk behind surface planer, chipping hammer, manhole, catch basin or inlet installing, mortar mixer, laser men. *Micropaving and crack sealing.

CLASS 3: Asbestos, toxic, bio remediation and phyto-remediation, lead or hazardous materials abatement when certification or license is required, Drilling Equipment Only Where a Separate Air Compressor Unit Supplies Power.

CLASS 4: Asphalt screedman, blaster, all laborers involved in pipejacking and boring operations not exceeding more than 10 feet into pipe, boring or drilled area.

WAGES: (per hour)	07/01/2023	06/01/2024 Additional
Class 1	$ 40.80	$ 2.65**
Class 2	44.80	2.35**
Class 3	49.40	2.45**
Class 4	54.70	2.20**

* When laborers are performing micro paving, crack sealing or slurry application when not part of asphalt prep operations laborers shall receive an additional $2.50 per hour over rate.

**To be allocated at a later date.

SHIFT DIFFERENTIAL: Night work and irregular shift require 20% increase on wages for all Government mandated night and irregular shift work.

NOTE - The 'Employer Registration' (30.1) use of a '4 Day/10 Hour Work schedules' will no longer be accepted or processed. All registered projects prior to June 30,2023 will expire within the granted time frame.

For Pre-Registered Projects Four (4), Ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day. Tuesday thru Friday may be worked with no make-up day. For further clarification contact your local Bureau Office.

SUPPLEMENTAL BENEFITS

Per hour:	
Journeyman	$ 32.28
Shift	37.96

OVERTIME PAY

See (B, E, P, *R, **S, ***T, X) on OVERTIME PAGE
*For Mon-Fri Holidays, Double Benefits to be paid for all hours worked.
**For Saturday Holidays, Two and one Half Benefits for all hours worked.
***For Sunday Holidays, Triple Benefits for all hours worked.

HOLIDAY

Paid: See (5, 6, 15, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 15, 25) on HOLIDAY PAGE
To be eligible for a paid holiday, an employee must work at least two (2) days in the calendar week or payroll week in which the holiday falls.

REGISTERED APPRENTICES

(1000) hour terms at the following wages.

	07/01/2023	06/01/2024
1st term	$ 27.05	$ 28.05
2nd term	31.25	32.35
3rd term	35.40	36.70
4th term	39.55	41.00

Supplemental Benefits per hour:		
All Terms Regular	$ 28.33	$ 29.23
All Terms Shift Rate	33.08	TBD

11-17.1H/H

Laborer - Tunnel 02/01/2024

JOB DESCRIPTION Laborer - Tunnel **DISTRICT** 11

ENTIRE COUNTIES
Columbia, Dutchess, Greene, Orange, Otsego, Putnam, Rockland, Sullivan, Ulster, Westchester

PARTIAL COUNTIES
Chenango: Townships of Columbus, Sherburne and New Berlin.
Delaware: Townships of Andes, Bovina, Middletown, Roxbury, Franklin, Hamden, Stamford, Delhi, Kortright, Harpersfield, Merideth and Davenport.

WAGES
Class 1: All support laborers/sandhogs working above the shaft or tunnel.

Class 2: All laborers/sandhogs working in the shaft or tunnel.

Class 4: Safety Miners

Class 5: Site work related to Shaft/Tunnel

WAGES: (per hour)

	07/01/2023	06/01/2024	06/01/2025
Class 1	$ 55.55	$ 57.05	$ 58.55
Class 2	57.70	59.20	60.70
Class 4	64.10	65.60	67.10
Class 5	47.65	49.90	51.40

Toxic and hazardous waste, lead abatement and asbestos abatement work will be paid an additional $ 3.00 an hour.

SHIFT DIFFERENTIAL...On all Government mandated irregular shift work:
- Employee shall be paid at time and one half the regular rate Monday through Friday.
- Saturday shall be paid at 1.65 times the regular rate.
- Sunday shall be paid at 2.15 times the regular rate.

SUPPLEMENTAL BENEFITS
Per hour:

Benefit 1	$ 35.73	$ 36.98	$ 38.23
Benefit 2	51.01	TBD	TBD
Benefit 3	71.28	TBD	TBD

Benefit 1 applies to straight time hours, paid holidays not worked.
Benefit 2 applies to over 8 hours in a day (M-F), irregular shift work hours worked, and Saturday hours worked.
Benefit 3 applies to Sunday and Holiday hours worked.

OVERTIME PAY
See (B, E, Q, X) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 15, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 15, 16, 25) on HOLIDAY PAGE
When a recognized Holidays falls on Saturday or Sunday, holidays falling on Saturday shall be recognized or observed on Friday and holidays falling on Sunday shall be recognized or observed on Monday. Employees ordered to work on the Saturday or Sunday of the holiday or on the recognized or the observed Friday or Monday for those holidays falling on Saturday or Sunday shall receive double time the established rate and benefits for the holiday.

REGISTERED APPRENTICES
FOR APPRENTICE RATES, refer to the appropriate Laborer Heavy & Highway wage rate contained in the wage schedule for the County and location where the work is to be performed.

11-17/60/235/754Tun

Lineman Electrician 02/01/2024

JOB DESCRIPTION Lineman Electrician **DISTRICT** 6

ENTIRE COUNTIES
Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Wyoming, Yates

WAGES

A Lineman/Technician shall perform all overhead aerial work. A Lineman/Technician on the ground will install all electrical panels, connect all grounds, install and connect all electrical conductors, assembly of all electrical materials, conduit, pipe, or raceway; placing of fish wire; pulling of cables, wires or fiber optic cable through such raceways; splicing of conductors; dismantling of such structures, lines or equipment.

A Groundman/Truck Driver shall: Build and set concrete forms, handle steel mesh, set footer cages, transport concrete in a wheelbarrow, hand or machine concrete vibrator, finish concrete footers, mix mortar, grout pole bases, cover and maintain footers while curing in cold weather, operate jack hammer, operate hand pavement breaker, tamper, concrete and other motorized saws, as a drill helper, operate and maintain generators, water pumps, chainsaws, sand blasting, operate mulching and seeding machine, air tools, electric tools, gas tools, load and unload materials, hand shovel and/or broom, prepare and pour mastic and other fillers, assist digger operator/equipment operator in ground excavation and restoration, landscape work and painting. Only when assisting a lineman technician, a groundman/truck driver may assist in installing conduit, pipe, cables and equipment.

NOTE: Includes Teledata Work within ten (10) feet of High Voltage Transmission Lines. Also includes digging of holes for poles, anchors, footer, and foundations for electrical equipment.

Below rates applicable on all overhead and underground distribution and maintenance work, and all overhead and underground transmission line work and the installation of fiber optic cable where no other construction trades are or have been involved. (Ref #14.01.01)

Per hour:	07/01/2023	05/06/2024
Lineman, Technician	$ 57.40	$ 58.90
Crane, Crawler Backhoe	57.40	58.90
Welder, Cable Splicer	57.40	58.90
Digging Mach. Operator	51.66	53.01
Tractor Trailer Driver	48.79	50.07
Groundman, Truck Driver	45.92	47.12
Equipment Mechanic	45.92	47.12
Flagman	34.44	35.34

Additional $1.00 per hour for entire crew when a helicopter is used.

Below rates applicable on all electrical sub-stations, switching structures, fiber optic cable and all other work not defined as "Utility outside electrical work". (Ref #14.02.01-A)

Lineman, Technician	$ 57.40	$ 58.90
Crane, Crawler Backhoe	57.40	58.90
Cable Splicer	63.14	64.79
Certified Welder, Pipe Type Cable	60.27	61.85
Digging Mach. Operator	51.66	53.01
Tractor Trailer Driver	48.79	50.07
Groundman, Truck Driver	45.92	47.12
Equipment Mechanic	45.92	47.12
Flagman	34.44	35.34

Additional $1.00 per hour for entire crew when a helicopter is used.

Below rates apply on switching structures, maintenance projects, railroad catenary install/maintenance third rail installation, bonding of rails and pipe type cable and installation of fiber optic cable. (Ref #14.02.01-B)

Lineman, Tech, Welder	$ 58.72	$ 60.22
Crane, Crawler Backhoe	58.72	60.22
Cable Splicer	64.59	66.24
Certified Welder, Pipe Type Cable	61.66	63.23
Digging Mach. Operator	52.85	54.20
Tractor Trailer Driver	49.91	51.19
Groundman, Truck Driver	46.98	48.18
Equipment Mechanic	46.98	48.18
Flagman	35.23	36.13

Additional $1.00 per hour for entire crew when a helicopter is used.

Below rates applicable on all overhead and underground transmission line work & fiber optic cable where other construction trades are or have been involved. This applies to transmission line work only, not other construction. (Ref #14.03.01)

Lineman, Tech, Welder	$ 59.91	$ 61.41

Crane, Crawler Backhoe	59.91	61.41
Cable Splicer	59.91	61.41
Digging Mach. Operator	53.92	55.27
Tractor Trailer Driver	50.92	52.20
Groundman, Truck Driver	47.93	49.13
Equipment Mechanic	47.93	49.13
Flagman	35.95	36.85

Additional $1.00 per hour for entire crew when a helicopter is used.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT	8:00 AM to 4:30 PM REGULAR RATE
2ND SHIFT	4:30 PM to 1:00 AM REGULAR RATE PLUS 17.3 %
3RD SHIFT	12:30 AM to 9:00 AM REGULAR RATE PLUS 31.4 %

NOTE - The "Employer Registration" (30.1) use of a '4 Day/10 Hour Work schedules' will no longer be accepted or processed. All registered projects prior to June 30, 2023 will expire within the granted time frame.

For Pre-Registered Projects Four (4), Ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day. Tuesday thru Friday may be worked with no make-up day. For further clarification contact your local Bureau Office.

SUPPLEMENTAL BENEFITS

Per hour:

	07/01/2023	05/06/2024
Lineman, Technician, or Equipment Operators with Crane License	$ 29.40 *plus 7% of the hourly wage paid	$ 30.90 *plus 7% of the hourly wage paid
All other Journeyman	$ 26.40 *plus 7% of the hourly wage paid	$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

OVERTIME PAY

See (B, E, Q, X) on OVERTIME PAGE. *Note* Double time for all emergency work designated by the Dept. of Jurisdiction.
NOTE: WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY

Paid	See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Governor of NYS Election Day.
Overtime	See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Governor of NYS Election Day.

NOTE: All paid holidays falling on Saturday shall be observed on the preceding Friday. All paid holidays falling on Sunday shall be observed on the following Monday. Supplements for holidays paid at straight time.

REGISTERED APPRENTICES

WAGES per hour: 1000 hour terms at the following percentage of the applicable Journeyman Lineman wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

07/01/2023	05/06/2024
$ 26.40 *plus 7% of the hourly wage paid	$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

6-1249a

Lineman Electrician - Teledata — 02/01/2024

JOB DESCRIPTION Lineman Electrician - Teledata **DISTRICT** 6

ENTIRE COUNTIES
Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES
Per hour:

For outside work, stopping at first point of attachment (demarcation).

	07/01/2023	01/01/2024	01/01/2025
Cable Splicer	$ 37.73	$ 39.24	$ 40.81
Installer, Repairman	$ 35.81	$ 37.24	$ 38.73
Teledata Lineman	$ 35.81	$ 37.24	$ 38.73
Tech., Equip. Operator	$ 35.81	$ 37.24	$ 38.73
Groundman	$ 18.98	$ 19.74	$ 20.53

NOTE: EXCLUDES Teledata work within ten (10) feet of High Voltage (600 volts and over) transmission lines. For this work please see LINEMAN.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED:

1ST SHIFT	REGULAR RATE
2ND SHIFT	REGULAR RATE PLUS 10%
3RD SHIFT	REGULAR RATE PLUS 15%

SUPPLEMENTAL BENEFITS

Per hour:	07/01/2023	01/01/2024	01/01/2025
Journeyman	$ 5.70 *plus 3% of the hourly wage paid	$ 5.70 *plus 3% of the hourly wage paid	$ 5.70 *plus 3% of the hourly wage paid

*The 3% is based on the hourly wage paid, straight time rate or premium rate.

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE
NOTE: WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16) on HOLIDAY PAGE

6-1249LT - Teledata

Lineman Electrician - Traffic Signal, Lighting — 02/01/2024

JOB DESCRIPTION Lineman Electrician - Traffic Signal, Lighting **DISTRICT** 6

ENTIRE COUNTIES
Columbia, Dutchess, Orange, Putnam, Rockland, Ulster

WAGES
Lineman/Technician shall perform all overhead aerial work. A Lineman/Technician on the ground will install all electrical panels, connect all grounds, install and connect all electrical conductors which includes, but is not limited to road loop wires; conduit and plastic or other type pipes that carry conductors, flex cables and connectors, and to oversee the encasement or burial of such conduits or pipes.

A Groundman/Truck Driver shall: Build and set concrete forms, handle steel mesh, set footer cages, transport concrete in a wheelbarrow, hand or machine concrete vibrator, finish concrete footers, mix mortar, grout pole bases, cover and maintain footers while curing in cold weather, operate jack hammer, operate hand pavement breaker, tamper, concrete and other motorized saws, as a drill helper, operate and maintain generators, water pumps, chainsaws, sand blasting, operate mulching and seeding machine, air tools, electric tools, gas tools, load and unload materials, hand shovel and/or broom, prepare and pour mastic and other fillers, assist digger operator/equipment operator in ground excavation and restoration, landscape work and painting. Only when assisting a lineman technician, a groundman/truck driver may assist in installing conduit, pipe, cables and equipment.

A flagger's duties shall consist of traffic control only.
(Ref #14.01.02)

Per hour:	07/01/2023	05/06/2024
Lineman, Technician	$ 50.60	$ 51.82
Crane, Crawler Backhoe	50.60	51.82
Certified Welder	53.13	54.41
Digging Machine	45.54	46.64
Tractor Trailer Driver	43.01	44.05
Groundman, Truck Driver	40.48	41.46
Equipment Mechanic	40.48	41.46
Flagman	30.36	31.09

Above rates are applicable for installation, testing, operation, maintenance and repair on all Traffic Control (Signal) and Illumination (Lighting) projects, Traffic Monitoring Systems, and Road Weather Information Systems. Includes digging of holes for poles, anchors, footer foundations for electrical equipment; assembly of all electrical materials or raceway; placing of fish wire; pulling of cables, wires or fiber optic cable through such raceways; splicing of conductors; dismantling of such structures, lines or equipment.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT	8:00 AM TO 4:30 PM REGULAR RATE
2ND SHIFT	4:30 PM TO 1:00 AM REGULAR RATE PLUS 17.3%
3RD SHIFT	12:30 AM TO 9:00 AM REGULAR RATE PLUS 31.4%

NOTE - The "Employer Registration" (30.1) use of a '4 Day/10 Hour Work schedules' will no longer be accepted or processed. All registered projects prior to June 30, 2023 will expire within the granted time frame.

For Pre-Registered Projects Four (4), Ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day. Tuesday thru Friday may be worked with no make-up day. For further clarification contact your local Bureau Office.

SUPPLEMENTAL BENEFITS
Per hour worked (but also required on non-worked holidays):

	07/01/2023	05/06/2024
Lineman, Technician, or Equipment Operators with Crane License	$ 29.40 *plus 7% of the hourly wage paid	$ 30.90 *plus 7% of the hourly wage paid
All other Journeyman	$ 26.40 *plus 7% of the hourly wage paid	$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE. *Note* Double time for all emergency work designated by the Dept. of Jurisdiction.
NOTE: WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY
Paid: See (5, 6, 8, 13, 25) on HOLIDAY PAGE and Governor of NYS Election Day.
Overtime: See (5, 6, 8, 13, 25) on HOLIDAY PAGE and Governor of NYS Election Day.

NOTE: All paid holidays falling on Saturday shall be observed on the preceding Friday. All paid holidays falling on Sunday shall be observed on the following Monday. Supplements for holidays paid at straight time.

REGISTERED APPRENTICES
WAGES per hour: 1000 hour terms at the following percentage of the applicable Journeyman Lineman wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

	07/01/2023	05/06/2024

	$ 26.40 *plus 7% of the hourly wage paid	$ 26.90 *plus 7% of the hourly wage paid

*The 7% is based on the hourly wage paid, straight time or premium time.

6-1249aReg8LT

Lineman Electrician - Tree Trimmer — 02/01/2024

JOB DESCRIPTION Lineman Electrician - Tree Trimmer **DISTRICT** 6

ENTIRE COUNTIES
Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Wyoming, Yates

WAGES
Applies to line clearance, tree work and right-of-way preparation on all new or existing energized overhead or underground electrical, telephone and CATV lines. This also would include stump removal near underground energized electrical lines, including telephone and CATV lines.

Per hour:	07/01/2023	12/31/2023
Tree Trimmer	$ 29.80	$ 31.44
Equipment Operator	26.35	27.80
Equipment Mechanic	26.35	27.80
Truck Driver	21.95	23.15
Groundman	18.07	19.07
Flag person	14.20	14.20*

*NOTE- Rate effective on 01/01/2024 - $15.00 due to minimum wage increase

SUPPLEMENTAL BENEFITS
Per hour:

	07/01/2023	12/31/2023
Journeyman	$ 10.48 *plus 4.5% of the hourly wage paid	$ 10.48 *plus 4.5% of the hourly wage paid

* The 4.5% is based on the hourly wage paid, straight time rate or premium rate.

OVERTIME PAY
See (B, E, Q, X) on OVERTIME PAGE
NOTE: WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked. Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY
Paid: See (5, 6, 8, 15) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 16, 25) on HOLIDAY PAGE
NOTE: All paid holidays falling on a Saturday shall be observed on the preceding Friday.
All paid holidays falling on a Sunday shall be observed on the following Monday.

6-1249TT

Mason - Building — 02/01/2024

JOB DESCRIPTION Mason - Building **DISTRICT** 11

ENTIRE COUNTIES
Dutchess, Sullivan, Ulster

PARTIAL COUNTIES
Orange: Entire county except the Township of Tuxedo.

WAGES
Per hour:

	07/01/2023
Bricklayer	$ 45.00

Cement Mason	45.00
Plasterer/Stone Mason	45.00
Pointer/Caulker	45.00

Additional $1.00 per hour for power saw work
Additional $0.50 per hour for swing scaffold or staging work

SHIFT WORK: When shift work or an irregular workday is mandated or required by state, federal, county, local or other governmental agency contracts, the following premiums apply:
Irregular workday requires 15% premium
Second shift an additional 15% of wage plus benefits to be paid
Third shift an additional 25% of wage plus benefits to be paid

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 37.39

OVERTIME PAY

Cement Mason	See (B, E, Q, W) on OVERTIME PAGE.
All Others	See (B, E, Q) on OVERTIME PAGE.

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 16, 25) on HOLIDAY PAGE

Whenever any of the above holidays fall on Sunday, they will be observed on Monday. Whenever any of the above holidays fall on Saturday, they will be observed on Friday.

REGISTERED APPRENTICES
Wages per hour:

750 hour terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Supplemental Benefits per hour

750 hour terms at the following percentage of journeyman supplements

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Apprentices indentured before June 1st, 2011 receive full journeyman benefits

11-5du-b

Mason - Building — 02/01/2024

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Dutchess, Orange, Putnam, Sullivan, Ulster

WAGES
Per hour:

	07/01/2023	12/04/2023	06/03/2024
Building:			Additional
Tile, Marble,& Terrazzo Mechanic/Setter	$ 57.29	$ 57.72	$ 0.64

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker:	$ 23.06* + $7.68	$ 23.26* +$7.69

* This portion of benefits subject to same premium rate as shown for overtime wages.

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE
Double time rate applies after 10 hours

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage per hour:
(Counties of Orange & Putnam)

750 hour terms at the following wage rate:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1-	751-	1501-	2251-	3001-	3751-	4501-	5251-	6001-	6751-
750	1500	2250	3000	3750	4500	5250	6000	6750	7500
07/01/2023									
$21.70	$26.66	$33.75	$38.69	$42.25	$45.70	$49.29	$54.23	$57.09	$61.25
12/04/2023									
$21.96	$26.95	$34.10	$39.08	$42.68	$46.16	$49.79	$54.77	$57.66	$61.90

Supplemental Benefits per hour:
(Counties of Orange & Putnam)

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
07/01/2023									
$12.55*	$12.55*	$15.36*	$15.36*	$16.36*	$17.86*	$18.86*	$18.86*	$16.86*	$22.11*
+$0.73	+$0.78	+$0.88	+$0.88	+$1.37	+$1.42	+$1.83	+$1.88	+$6.03	+$6.61
12/04/2023									
$12.55*	$12.55*	$15.36*	$15.36*	$16.36*	$17.86*	$18.86*	$18.86*	$16.86*	$22.11*
+$0.73	+$0.78	+$0.89	+$0.94	+$1.38	+$1.43	+$1.84	+$1.89	+$6.04	+$6.62

Wages per hour:
(Counties of Dutchess, Sullivan, Ulster)

750 hour terms at the following wage rate:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1-	751-	1501-	2251-	3001-	3751-	4501-	5251-	6001-	6751-
750	1500	2250	3000	3750	4500	5250	6000	6750	7500
07/01/2023									
$19.83	$23.92	$25.89	$29.98	$32.74	$36.32	$39.61	$42.71	$44.31	$47.73

Supplemental Benefits per hour:
(Counties of Dutchess, Sullivan, Ulster)

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
07/01/2023									
$12.55*	$12.55*	$14.66*	$14.66*	$15.60*	$16.16*	$16.66*	$17.66*	$15.66*	$20.41*
+$0.65	+$0.69	+$0.74	+$0.78	+$1.15	+$1.19	+$1.53	+$1.57	+$6.09	+$6.18

* This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/52B

Mason - Building — 02/01/2024

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Dutchess, Orange, Putnam, Sullivan, Ulster

WAGES
Per hour: 07/01/2023 12/04/2023 06/03/2024

Building			Additional
Tile, Marble, & Terrazzo Finisher	$ 47.06	$ 47.51	$ 0.54

SUPPLEMENTAL BENEFITS
Journeyworker:

Per Hour	$ 20.16*	$ 20.26*
	+ $7.55	+ $7.55

*This portion of benefits subject to same premium rate as shown for overtime wages

OVERTIME PAY
See (A, *E, Q) on OVERTIME PAGE
Double time rate applies after 10 hours on Saturdays.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

9-7/88B-tf

Mason - Building — 02/01/2024

JOB DESCRIPTION Mason - Building **DISTRICT** 11

ENTIRE COUNTIES
Putnam, Rockland, Westchester

PARTIAL COUNTIES
Orange: Only the Township of Tuxedo.

WAGES
Per hour:

	07/01/2023
Bricklayer	$ 45.89
Cement Mason	45.89
Plasterer/Stone Mason	45.89
Pointer/Caulker	45.89

Additional $1.00 per hour for power saw work
Additional $0.50 per hour for swing scaffold or staging work

SHIFT WORK: When shift work or an irregular workday is mandated or required by state, federal, county, local or other governmental agency contracts, the following premiums apply:
Irregular workday requires 15% premium
Second shift an additional 15% of wage plus benefits to be paid
Third shift an additional 25% of wage plus benefits to be paid

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 37.95

OVERTIME PAY
OVERTIME:
Cement Mason See (B, E, Q, W) on OVERTIME PAGE.
All Others See (B, E, Q) on OVERTIME PAGE.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE
Whenever any of the above holidays fall on Sunday, they will be observed on Monday. Whenever any of the above holidays fall on Saturday, they will be observed on Friday.

REGISTERED APPRENTICES
Wages per hour:

750 hour terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Supplemental Benefits per hour

750 hour terms at the following percentage of journeyman supplements

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Apprentices indentured before June 1st, 2011 receive full journeyman benefits

11-5wp-b

Mason - Building 02/01/2024

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES
Per Hour:

	07/01/2023	7/03/2023
Marble Cutters & Setters	$ 62.82	$ 63.12

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker	$ 39.03	$ 39.34

OVERTIME PAY
See (B, E, Q, V) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage Per Hour:
07/01/2023
750 hour terms at the following wage

1st	2nd	3rd	4th	5th	6th	7th	8th
0-3000	3001-3750	3751-4500	4501-5250	5251-6000	6001-6750	6751-7500	7500+
$ 26.42	$ 39.62	$ 42.91	$ 46.22	$ 49.52	$ 53.38	$ 59.67	$ 62.82

Supplemental Benefits per hour:
07/01/2023

1st	2nd	3rd	4th	5th	6th	7th	8th
$ 25.38	$ 28.86	$ 29.74	$ 30.60	$ 31.48	$ 36.44	$ 38.17	$ 39.03

07/03/2023
Wage Per Hour:

750 hour terms at the following wage.

1st	2nd	3rd	4th	5th	6th	7th	8th
0-3000	3001-3750	3751-4500	4501-5250	5251-6000	6001-6750	6751-7500	7500+
$ 26.60	$ 39.82	$ 43.13	$ 46.45	$ 49.78	$ 53.64	$ 59.95	$ 63.12

Supplemental Benefits Per Hour:

1st	2nd	3rd	4th	5th	6th	7th	8th
$ 25.54	$ 29.09	$ 29.97	$ 30.84	$ 31.72	$ 36.73	$ 38.48	$ 39.34

9-7/4

Mason - Heavy&Highway 02/01/2024

JOB DESCRIPTION Mason - Heavy&Highway **DISTRICT** 11

ENTIRE COUNTIES
Dutchess, Sullivan, Ulster

PARTIAL COUNTIES
Orange: Entire county except the Township of Tuxedo.

WAGES
Per hour:

	07/01/2023
Bricklayer	$ 45.50
Cement Mason	45.50
Marble/Stone Mason	45.50
Plasterer	45.50
Pointer/Caulker	45.50

Additional $1.00 per hour for power saw work
Additional $0.50 per hour for swing scaffold or staging work

SHIFT WORK: When shift work or an irregular workday is mandated or required by state, federal, county, local or other governmental contracts, the following rates apply:
Irregular workday requires 15% premium
Second shift an additional 15% of wage plus benefits to be paid
Third shift an additional 25% of wage plus benefits to be paid

SUPPLEMENTAL BENEFITS
Per hour:
Journeyman $ 37.39

OVERTIME PAY
Cement Mason See (B, E, Q, W)
All Others See (B, E, Q)

HOLIDAY
Paid: See (5, 6, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE
- Whenever any of the above holidays fall on Sunday, they will be observed on Monday. Whenever any of the above holidays fall on Saturday, they will be observed on Friday.
- Supplemental Benefits are not paid for paid Holiday
- If Holiday is worked, Supplemental Benefits are paid for hours worked.
- Whenever an Employee works within three (3) calendar days before a holiday, the Employee shall be paid for the Holiday.

REGISTERED APPRENTICES
Wages per hour:

750 hour terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Supplemental Benefits per hour

750 hour terms at the following percentage of journeyman supplements

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Apprentices indentured before June 1st, 2011 receive full journeyman benefits

11-5du-H/H

Mason - Heavy&Highway **02/01/2024**

JOB DESCRIPTION Mason - Heavy&Highway **DISTRICT** 11

ENTIRE COUNTIES
Putnam, Rockland, Westchester

PARTIAL COUNTIES
Orange: Only the Township of Tuxedo.

WAGES
Per hour:

07/01/2023

Bricklayer	$ 46.39
Cement Mason	46.39
Marble/Stone Mason	46.39
Plasterer	46.39
Pointer/Caulker	46.39

Additional $1.00 per hour for power saw work
Additional $0.50 per hour for swing scaffold or staging work

SHIFT WORK: When shift work or an irregular workday is mandated or required by state, federal, county, local or other governmental contracts, the following rates apply:

Irregular workday requires 15% premium
Second shift an additional 15% of wage plus benefits to be paid
Third shift an additional 25% of wage plus benefits to be paid

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 37.95

OVERTIME PAY

Cement Mason	See (B, E, Q, W)
All Others	See (B, E, Q,)

HOLIDAY

Paid:	See (5, 6, 16, 25) on HOLIDAY PAGE
Overtime:	See (5, 6, 16, 25) on HOLIDAY PAGE

- Whenever any of the above holidays fall on Sunday, they will be observed on Monday. Whenever any of the above holidays fall on Saturday, they will be observed on Friday.
- Supplemental Benefits are not paid for paid Holiday
- If Holiday is worked, Supplemental Benefits are paid for hours worked.
- Whenever an Employee works within three (3) calendar days before a holiday, the Employee shall be paid for the Holiday.

REGISTERED APPRENTICES
Wages per hour:

750 hour terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Supplemental Benefits per hour

750 hour terms at the following percentage of journeyman supplements

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Apprentices indentured before June 1st, 2011 receive full journeyman benefits

11-5WP-H/H

Operating Engineer - Building / Heavy&Highway 02/01/2024

JOB DESCRIPTION Operating Engineer - Building / Heavy&Highway **DISTRICT** 11

ENTIRE COUNTIES
Delaware, Orange, Rockland, Sullivan, Ulster

WAGES
CLASS A5: Cranes, Derricks and Pile Drivers 100 tons or more and Tower Cranes, with 140ft boom and over.
CLASS A4: Cranes, Derricks and Pile Drivers 100 tons or more and Tower Cranes, with 100ft to 139ft boom.
CLASS A3: Cranes, Derricks and Pile Drivers 100 tons or more and Tower Cranes with a boom under 100ft.
CLASS A2: Cranes, Derricks and Pile Drivers less than 100 tons with 140ft boom and over.
CLASS A1: Cranes, Derricks and Pile Drivers less than 100 tons with a 100ft to 139ft boom.

CLASS A: Cranes, Derricks and Pile Drivers less than 100 tons with a boom under 100ft.; Autograde Combination Subgrader, Base Material Spreader and Base Trimmer (CMI and Similar Types); Autograde Pavement profiler (CMI and Similar Types); Autograde Pavement Profiler and Recycle type (CMI and Similar Type); Autograde Placer-Trimmer-Spreader Comb. (CMI & Similar types); Autograde Slipform Paver (CMI & Similar Types); Central Power Plants (all types); Chief of Party; Concrete Paving Machines; Drill (Bauer, AMI and Similar Types); Drillmaster, Quarrymaster (Down the Hole Drill), Rotary Drill, Self-Propelled Hydraulic Drill, Self-Powered Drill; Draglines; Elevator Graders; Excavator; Front End Loaders (5 yds. and over); Gradalls; Grader-Rago; Helicopters (Co-Pilot); Helicopters (Communications Engineer);Juntann Pile Driver; Locomotive (Large); Mucking Machines; Pavement & Concrete Breaker, i.e., Superhammer & Hoe Ram; Roadway Surface Grinder; Prentice Truck; Scooper (Loader and Shovel); Shovels; Tree Chopper with Boom; Trench Machines (Cable Plow); Tunnel Boring Machine; Vacuum Truck

CLASS B: "A" Frame; Backhoe (Combination); Boom Attachment on Loaders (Rate based on size of Bucket) not applicable to Pipehook; Boring and Drilling Machines; Brush Chopper, Shredder and Tree Shredder, Tree Shearer; Bulldozer(Fine Grade); Cableways; Carryalls; Concrete Pump; Concrete Pumping System, Pump Concrete and Similar Types; Conveyors (125 ft. and over); Drill Doctor (duties incl. Dust Collector Maintenance); Front End Loaders (2 yds. but less than 5 yds.); Graders (Finish); Groove Cutting Machine (Ride on Type); Heater Planer; Hoists (all type Hoists, shall also include Steam, Gas, Diesel, Electric, Air Hydraulic, Single and Double Drum, Concrete, Brick Shaft Caisson, Snorkel Roof, and/or any other Similar Type Hoisting Machines, portable or stationary, except Chicago Boom Type); Long Boom Rate to be applied if Hoist is "Outside Material Tower Hoist"**; Hydraulic Cranes-10 tons and under; Hydraulic Dredge; Hydro-Axe; Hydro Blaster; Jacks-Screw Air Hydraulic Power Operated Unit or Console Type (not hand Jack or Pile Load Test Type); Log Skidder; Pans; Pavers (all) concrete; Plate and Frame Filter Press; Pumpcrete Machines, Squeezecrete & Concrete Pumping (regardless of size); Scrapers; Side Booms; "Straddle"Carrier-Ross and similar types; Winch Trucks (Hoisting); Whip Hammer

CLASS C: Asphalt Curbing Machine; Asphalt Plant Engineer; Asphalt Spreader; Autograde Tube Finisher and Texturing Machine (CMI & Similar types); Autograde Curecrete Machine (CMI & Similar Types); Autograde Curb Trimmer & Sidewalk, Shoulder, Slipform (CMI & Similar Types); Bar Bending Machines (Power); Barrier Moving Machine-Zipper; Batchers, Batching Plant and Crusher on Site; Belt Conveyor Systems; Boom Type Skimmer Machines; Bridge Deck Finisher; Bulldozer(except fine grade); Car Dumpers (Railroad); Compressor and Blower Type Units (used independently or mounted on dual purpose Trucks, on Job Site or in conjunction with jobsite, in Loading and Unloading of Concrete, Cement, Fly Ash, Instantcrete, or Similar Type Materials); Compressors (2 or 3 in Battery); Concrete Finishing Machines; Concrete cleaning decontamination machine operator; Concrete Saws and Cutters (Ride-on type); Concrete Spreaders (Hetzel, Rexomatic and Similar Types); Concrete Vibrators; Conveyors (under 125 feet); Crushing Machines; Directional Boring Machines; Ditching Machine-small (Ditch-witch, Vermeer, or Similar type); Dope Pots (Mechanical with or without pump); Dumpsters; Elevator; Fireman; Fork Lifts (Economobile, Lull and Similar Types of Equipment); Front End Loaders (1 yd. and over but under 2 yds.); Generators (2 or 3 in Battery); Giraffe Grinders; Grout Pump; Gunnite Machines (excluding nozzle); Hammer Vibrator (in conjunction with Generator); Heavy Equipment Robotics Operator Technician; Hoists-Roof, Tugger, Aerial Platform Hoist & House Cars; Hoppers; Hopper Doors (power operated); Hydro Blaster; Hydraulic Jacking Trailer; Ladders (motorized); Laddervator; Locomotive-dinky type; Maintenance -Utility Man; Master Environmental Maintenance Technician; Mechanics; Mixers (Excepting Paving Mixers); Motor Patrols; Pavement Breakers (small self - propelled ride on type-also maintains compressor hydraulic unit); Pavement Breaker-truck mounted; Pipe Bending Machine (Power); Pitch Pump; Plaster Pump (regardless of size); Post Hole Digger (Post Pounder & Auger); Pot Hole Killer Trucks or equivalent; Rod Bending Machines (Power); Roller-Black Top; Scales (Power); Seaman pulverizing mixer; Shoulder widener; Silos; Skidsteer (all attachments); Skimmer Machines (boom-type); Steel Cutting Machine (service & maintain); Tam Rock Drill; Tractors; Transfer Machine; Captain (Power Boats); Tug Master (powerboats); Ultra High Pressure Waterjet Cutting Tool System operator/maintenance technician; Vacuum Blasting Machine; Vibrating Plants (used in conjunction with unloading); Welder and Repair Mechanics

CLASS D: Brooms and Sweepers; Chippers; Compressor (single); Concrete Spreaders (small type); Conveyor Loaders (not including Elevator Graders); Engines-large diesel (1620 HP) and Staging Pump; Farm Tractors; Fertilizing Equipment (Operation & Maintenance of); Fine Grade Machine (small type); Form Line Graders (small type); Front End Loader (under 1 yard); Generator (single); Grease, Gas, Fuel and Oil supply trucks; Heaters (Nelson or other type incl. Propane, Natural Gas or Flowtype Units); Lights, Portable Generating Light Plants; Mixers (Concrete, small); Mulching Equipment (Operation and Maintenance of); Pumps (2 or less than 4 inch suction); Pumps (4 inch suction and over incl. submersible pumps); Pumps (Diesel Engine and Hydraulic-immaterial of power); Road Finishing Machines (small type); Rollers-grade, fill or stone base; Seeding Equip. (Operation and Maintenance of); Sprinkler & Water Pump Trucks (used on jobsite or in conjunction with jobsite); Steam Jennies and Boilers-irrespective of use; Stone Spreader; Tamping Machines, Vibrating Ride-on; Temporary Heating Plant (Nelson or other type, incl. Propane, Natural Gas or Flow Type Units); Water & Sprinkler Trucks (used on or in conjunction with jobsite); Welding Machines (Gas, Diesel, and/or Electric Converters of any type, single, two, or three in a battery); Wellpoint Systems (including installation by Bull Gang and Maintenance of)

CLASS E: Assistant Engineer/Oiler; Drillers Helper; Maintenance Apprentice (Deck Hand); Maintenance Apprentice (Oiler); Mechanics' Helper; Tire Repair and Maintenance; Transit/Instrument Man

WAGES:(per hour)

	07/01/2023	07/01/2024 Additional	07/01/2025 Additional
Class A5	$ 65.72 plus 4.00*	$ 2.75***	$ 2.50***
Class A4	64.72 plus 4.00*	2.75***	2.50***
Class A3	63.72 plus 4.00*	2.75***	2.50***
Class A2	61.22 plus 4.00*	2.75***	2.50***
Class A1	60.22 plus 4.00*	2.75***	2.50***
Class A	59.22 plus 4.00*	2.75***	2.50***
Class B	57.63 plus 4.00*	2.75***	2.50***

Class C	55.72 plus 4.00*	2.75***	2.50***
Class D	54.09 plus 4.00*	2.75***	2.50***
Class E	50.38 plus 4.00*	2.75***	2.50***
Safety Engineer	59.96 plus 4.00*	2.75***	2.50***
Helicopter:			
Pilot/Engineer	61.04 plus 4.00*	2.75***	2.50***
Co Pilot	59.22 plus 4.00*	2.75***	2.50***
Communications Engineer	59.22 plus 4.00*	2.75***	2.50***
Surveying:			
Chief of Party	59.22 plus 4.00*	2.75***	2.50***
Transit/Instrument Man	50.38 plus 4.00*	2.75***	2.50***
Rod/Chainman	49.80 plus 4.00*	2.75***	2.50***

Additional $0.75 for Survey work Tunnel under compressed air.
Additional $0.50 for Hydrographic work.

*The $4.00 is added to the Class Base Wage for all hours worked. Additionally, the $4.00 is subject to the V-Code listed on the OVERTIME CODE Sheet.

**Outside Material Hoist (Class B) receives additional $ 1.00 per hour on 110 feet up to 199 feet total height, $ 2.00 per hour on 200 feet and over total height.

***To be allocated at a later date

- SHIFT WORK: On all Government mandated irregular or off shift work, an additional 15% on straight time hours.

- On HAZARDOUS WASTE REMOVAL or ASBESTOS REMOVAL work, or any state or federally DESIGNATED HAZARDOUS WASTE SITE:

For projects bid on or before April 1, 2020...Where the Operating Engineer is in direct contact with hazardous material and when personal protective equipment is required for respiratory, skin and eye protection, the Operating Engineer shall receive the hourly wage plus an additional twenty percent (20%) of that wage for the entire shift.

For projects bid after April 1, 2020...On hazardous waste removal work of any kind, including state or federally designated site where the operating engineer is required to wear level A, B, or C personal protection the operating engineer shall receive an hourly wage rate of his regular hourly wage plus $5.00 per hour. An operating engineer working at a hazardous waste removal project or site at a task requiring hazardous waste related certification, but who is not working in a zone requiring level A, B, or C personal protection, shall receive an hourly wage rate of his regular rate plus $ 1.00 per hour. This shall also apply to sites where the level D personal protection is required.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 33.50

SHIFT WORK: On all Government mandated irregular or off shift work, an additional 15% on straight time hours.

OVERTIME PAY
See (B, E, Q, *V, X) on OVERTIME PAGE
*15% premium is also required on shift work benefits

HOLIDAY
Paid: See (5, 6, 10, 13, 15) on HOLIDAY PAGE
Overtime: See (5, 6, 10, 13, 15) on HOLIDAY PAGE
Holidays falling on Sunday will be celebrated on Monday.

REGISTERED APPRENTICES
(1) year terms at the following percentage of journeyman's wage:

1st year	60% of Class base wage plus $4.00*
2nd year	70% of Class base wage plus $4.00*
3rd year	80% of Class base wage plus $4.00*
4th year	90% of Class base wage plus $4.00*

*The $4.00 is added to the Class Base Wage for all hours worked. Additionally, the $4.00 is subject to the V-Code listed on the OVERTIME CODE Sheet.

Supplemental Benefits per hour:

Apprentices	$ 33.50

Operating Engineer - Marine Dredging 02/01/2024

JOB DESCRIPTION Operating Engineer - Marine Dredging **DISTRICT** 4

ENTIRE COUNTIES
Albany, Bronx, Cayuga, Clinton, Columbia, Dutchess, Essex, Franklin, Greene, Jefferson, Kings, Monroe, Nassau, New York, Orange, Oswego, Putnam, Queens, Rensselaer, Richmond, Rockland, St. Lawrence, Suffolk, Ulster, Washington, Wayne, Westchester

WAGES
These wages do not apply to Operating Engineers on land based construction projects. For those projects, please see the Operating Engineer Heavy/Highway Rates. The wage rates below for all equipment and operators are only for marine dredging work in navigable waters found in the counties listed above.

Per Hour:	07/01/2023	10/01/2023
CLASS A1 Deck Captain, Leverman Mechanical Dredge Operator Licensed Tug Operator 1000HP or more.	$ 43.94	$ 45.26
CLASS A2 Crane Operator (360 swing)	39.16	40.33
CLASS B Dozer, Front Loader Operator on Land	To conform to Operating Engineer Prevailing Wage in locality where work is being performed including benefits.	
CLASS B1 Derrick Operator (180 swing) Spider/Spill Barge Operator Operator II, Fill Placer, Engineer, Chief Mate, Electrician, Chief Welder, Maintenance Engineer Licensed Boat, Crew Boat Operator	38.00	39.14
CLASS B2 Certified Welder	35.77	36.84
CLASS C1 Drag Barge Operator, Steward, Mate, Assistant Fill Placer	34.79	35.83
CLASS C2 Boat Operator	33.67	34.68
CLASS D Shoreman, Deckhand, Oiler, Rodman, Scowman, Cook, Messman, Porter/Janitor	27.97	28.81

SUPPLEMENTAL BENEFITS
Per Hour:
THE FOLLOWING SUPPLEMENTAL BENEFITS APPLY TO ALL CATEGORIES

All Classes A & B	$ 11.85 plus 6% of straight time wage, Overtime hours add $ 0.63	$ 12.00 plus 6% of straight time wage, Overtime hours add $ 0.63
All Class C	$ 11.60 plus 6% of straight time wage, Overtime hours add $ 0.50	$ 11.75 plus 6% of straight time wage, Overtime hours add $ 0.50

All Class D	$ 11.35 plus 6% of straight time wage, Overtime hours add $ 0.38	$ 11.60 plus 6% of straight time wage, Overtime hours add $ 0.50

OVERTIME PAY
See (B2, F, R) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 26) on HOLIDAY PAGE

4-25a-MarDredge

Operating Engineer - Steel Erectors 02/01/2024

JOB DESCRIPTION Operating Engineer - Steel Erectors **DISTRICT** 11

ENTIRE COUNTIES
Delaware, Orange, Rockland, Sullivan, Ulster

WAGES
CLASS A3: Cranes, Derricks and Pile Drivers 100 tons or more and Tower Cranes, with a 140 ft. boom and over.

CLASS A2: Cranes, Derricks and Pile Drivers 100 tons or more and Tower Cranes, with up to a 139 ft. boom and under.

CLASS A1: Cranes, Derricks and Pile Drivers less than 100 tons with a 140 ft. boom and over.

CLASS A: Cranes, Derricks and Pile Drivers less than 100 tons with up to a 139 ft. boom and under.

CLASS B: "A" Frame; Cherry Pickers(10 tons and under); Hoists (all type Hoists, shall also include Steam, Gas, Diesel, Electric, Air Hydraulic, Single and Double Drum, Concrete, Brick Shaft Caisson, Snorkel Roof, and/or any other Similar Type Hoisting Machines, portable or stationary, except Chicago Boom Type); Jacks-Screw Air Hydraulic Power Operated Unit or Console Type (not hand Jack or Pile Load Test Type); Side Booms; Straddle Carrier

CLASS C: Aerial Platform used as Hoist; Compressors (2 or 3 in Battery); Concrete cleaning/ decontamination machine operator; Directional Boring Machines; Elevator or House Cars; Conveyers and Tugger Hoists; Fireman; Fork Lifts; Generators (2 or 3 in Battery); Heavy Equipment Robotics Operator/Technician; Master Environmental Maintenance Technician; Maintenance -Utility Man; Rod Bending Machines (Power); Captain(powerboat); Tug Master; Ultra High Pressure Waterjet Cutting Tool System; Vacuum Blasting Machine; Welding Machines(gas or electric,2 or 3 in battery, including diesels); Transfer Machine; Apprentice Engineer/Oiler with either one compressor or one welding machine when used for decontamination and remediation

CLASS D: Compressor (single); Welding Machines (Gas, Diesel, and/or Electric Converters of any type); Welding System Multiple (Rectifier Transformer type)

CLASS E: Assistant Engineer/Oiler; Maintenance Apprentice (Deck Hand);Drillers Helper; Maintenance Apprentice (Oiler); Mechanics' Helper; Transit/Instrument Man

WAGES:(per hour)

	07/01/2023	07/01/2024 Additional	07/01/2025 Additional
Class A3	$ 67.74 plus 4.00*	$ 2.75**	$ 2.50**
Class A2	66.08 plus 4.00*	2.75**	2.50**
Class A1	63.24 plus 4.00*	2.75**	2.50**
Class A	61.58 plus 4.00*	2.75**	2.50**
Class B	58.79 plus 4.00*	2.75**	2.50**
Class C	56.13 plus 4.00*	2.75**	2.50**
Class D	54.60 plus 4.00*	2.75**	2.50**
Class E	50.84 plus 4.00*	2.75**	2.50**
Vacuum Truck	59.55 plus 4.00*	2.75**	2.50**
Safety Engineer	60.41 plus 4.00*	2.75**	2.50**
Helicopter:			
Pilot/Engineer	63.24 plus 4.00*	2.75**	2.50**
Co Pilot	62.85 plus 4.00*	2.75**	2.50**
Communications Engineer	62.85 plus 4.00*	2.75**	2.50**
Surveying:			
Chief of Party	59.55 plus 4.00*	2.75**	2.50**
Transit/Instrument man	50.84 plus 4.00*	2.75**	2.50**

Rod/Chainman	49.80 plus 4.00*	2.75**	2.50**

Additional $0.75 for Survey work Tunnels under compressed air.
Additional $0.50 for Hydrographic work.

*The $4.00 is added to the Class Base Wage for all hours worked. Additionally, the $4.00 is subject to the V-Code listed on the OVERTIME CODE Sheet.

**To be allocated at a later date

- SHIFT WORK: On all Government mandated irregular or off shift work, an additional 15% on straight time hours.
- On HAZARDOUS WASTE REMOVAL or ASBESTOS REMOVAL work, or any state or federally DESIGNATED HAZARDOUS WASTE SITE:

For projects bid on or before April 1, 2020...Where the Operating Engineer is in direct contact with hazardous material and when personal protective equipment is required for respiratory, skin and eye protection, the Operating Engineer shall receive the hourly wage plus an additional twenty percent (20%) of that wage for the entire shift.

For projects bid after April 1, 2020...On hazardous waste removal work of any kind, including state or federally designated site where the operating engineer is required to wear level A, B, or C personal protection the operating engineer shall receive an hourly wage rate of his regular hourly wage plus $5.00 per hour. An operating engineer working at a hazardous waste removal project or site at a task requiring hazardous waste related certification, but who is not working in a zone requiring level A, B, or C personal protection, shall receive an hourly wage rate of his regular rate plus $ 1.00 per hour. This shall also apply to sites where the level D personal protection is required.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 33.50

OVERTIME PAY
See (B, E, Q, *V, X) on OVERTIME PAGE
*15% premium is also required on shift work benefits

HOLIDAY
Paid: See (5, 6, 10, 13, 15) on HOLIDAY PAGE
Overtime: See (5, 6, 10, 13, 15) on HOLIDAY PAGE
Holidays falling on Sunday will be celebrated on Monday.

REGISTERED APPRENTICES
(1) year terms at the following percentage of journeyman's wage.

1st year	60% of Class base wage plus $4.00*
2nd year	70% of Class base wage plus $4.00*
3rd year	80% of Class base wage plus $4.00*
4th year	90% of Class base wage plus $4.00*

*The $4.00 is added to the Class Base Wage for all hours worked. Additionally, the $4.00 is subject to the V-Code listed on the OVERTIME CODE Sheet.

Supplemental Benefits per hour:

Apprentices	$ 33.50

11-825SE

Painter 02/01/2024

JOB DESCRIPTION Painter **DISTRICT** 1

ENTIRE COUNTIES
Columbia, Dutchess, Greene, Orange, Sullivan, Ulster

WAGES
Per hour

	07/01/2023	07/01/2024 Additional
Brush/Paper Hanger	$ 37.97	+ $1.93*
Dry Wall Finisher	37.97	+ $1.93*
Lead Abatement	37.97	+ $1.93*
Sandblaster-Painter	37.97	+ $1.93*
Spray Rate	38.97	+ $1.93*

(*) To be allocated at later date.

See Bridge Painting rates for the following work:
Structural Steel, all work performed on tanks, ALL BRIDGES, towers, smoke stacks, flag poles. Rate shall apply to all of said areas from the ground up.

SUPPLEMENTAL BENEFITS
Per hour

Journeyperson	$ 26.28

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour

Six (6) month terms at the following percentage of Journeyperson's wage

1st	2nd	3rd	4th	5th	6th
50%	55%	65%	75%	85%	95%

Supplemental Benefits per hour worked

1st term	$ 11.14
All others	26.28

1-155

Painter - Bridge & Structural Steel — 02/01/2024

JOB DESCRIPTION Painter - Bridge & Structural Steel **DISTRICT** 8

ENTIRE COUNTIES
Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

WAGES
Per Hour:
STEEL:

Bridge Painting:	07/01/2023	10/01/2023
	$ 54.50	$ 56.00
	+ 10.10*	+ 10.35*

ADDITIONAL $6.50 per hour for POWER TOOL/SPRAY, whether straight time or overtime.

NOTE: All premium wages are to be calculated on base rate per hour only.

* For the period of May 1st to November 15th, this amount is payable up to 40 hours. For the period of Nov 16th to April 30th, this amount is payable up to 50 hours. EXCEPTION: First and last week of employment, and for the weeks of Memorial Day, Independence Day and Labor Day, where the amount is paid for the actual number of hours worked (no cap).

NOTE: Generally, for Bridge Painting Contracts, ALL WORKERS on and off the bridge (including Flagmen) are to be paid Painter's Rate; the contract must be ONLY for Bridge Painting.

SHIFT WORK:

When directly specified in public agency or authority contract documents for an employer to work a second shift and works the second shift with employees other than from the first shift, all employees who work the second shift will be paid 10% of the base wage shift differential in lieu of overtime for the first eight (8) hours worked after which the employees shall be paid at time and one half of the regular wage rate. When a single irregular work shift is mandated in the job specifications or by the contracting agency, wages shall be paid at time and one half for single shifts between the hours of 3pm-11pm or 11pm-7am.

SUPPLEMENTAL BENEFITS
Per Hour:
Journeyworker:

	$ 11.78	$ 12.43
	+ 30.85*	+ 31.55*

* For the period of May 1st to November 15th, this amount is payable up to 40 hours. For the period of Nov 16th to April 30th, this amount is payable up to 50 hours. EXCEPTION: First and last week of employment, and for the weeks of Memorial Day, Independence Day and Labor Day, where the amount is paid for the actual number of hours worked (no cap).

OVERTIME PAY
See (B, F, R) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (4, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage - Per hour:
Apprentices: (1) year terms.

1st year	$ 21.80	$ 22.40
	+ 4.04	+ 4.14
2nd year	$ 32.70	$ 33.60
	+ 6.06	+ 6.21
3rd year	$ 43.60	$ 44.80
	+ 8.08	+ 8.28
Supplemental Benefits - Per hour:		
1st year	$ .90	$ 1.16
	+ 12.34	+ 12.62
2nd year	$ 7.07	$ 7.46
	+ 18.51	+ 18.93
3rd year	$ 9.42	$ 9.94
	+ 24.68	+ 25.24

NOTE: All premium wages are to be calculated on base rate per hour only.

8-DC-9/806/155-BrSS

Painter - Line Striping — 02/01/2024

JOB DESCRIPTION Painter - Line Striping **DISTRICT** 8

ENTIRE COUNTIES
Albany, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Montgomery, Nassau, Orange, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

WAGES
Per hour:

Painter (Striping-Highway):	07/01/2023	01/01/2024	07/01/2024
Striping-Machine Operator*	$ 31.53	$ 31.53	$ 34.12
Linerman Thermoplastic	38.34	38.34	41.12

Note: * Includes but is not limited to: Positioning of cones and directing of traffic using hand held devices. Excludes the Driver/Operator of equipment used in the maintenance and protection of traffic safety.

NOTE - The "Employer Registration" (30.1) use of a '4 Day/10 Hour Work schedules' will no longer be accepted or processed. All registered projects prior to June 30,2023 will expire within the granted time frame.

For Pre-Registered Projects Four (4), Ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day. Tuesday thru Friday may be worked with no make-up day. For further clarification contact your local Bureau Office.

SUPPLEMENTAL BENEFITS
Per hour paid:
Journeyworker:

Striping Machine Operator:	$ 10.03	$ 22.24	$ 23.65
Linerman Thermoplastic:	10.03	22.24	23.65

OVERTIME PAY

See (B, B2, E2, F, S) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 20) on HOLIDAY PAGE
Overtime: See (5, 20) on HOLIDAY PAGE

REGISTERED APPRENTICES
One (1) year terms at the following wage rates:

1st Term:	$ 15.00	$ 15.00	$ 15.00
2nd Term:	18.92	18.92	20.47
3rd Term:	25.22	25.22	27.30

Supplemental Benefits per hour:

1st term:	$ 9.16	$ 22.24	$ 23.65
2nd Term:	10.03	22.24	23.65
3rd Term:	10.03	22.24	23.65

8-1456-LS

Painter - Metal Polisher — 02/01/2024

JOB DESCRIPTION Painter - Metal Polisher **DISTRICT** 8

ENTIRE COUNTIES
Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

	07/01/2023
Metal Polisher	$ 38.18
Metal Polisher*	39.28
Metal Polisher**	42.18

*Note: Applies on New Construction & complete renovation
** Note: Applies when working on scaffolds over 34 feet.

SUPPLEMENTAL BENEFITS
Per Hour: 07/01/2023

Journeyworker:
All classification $ 12.34

OVERTIME PAY
See (B, E, P, T) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:
One (1) year term at the following wage rates:

	07/01/2023
1st year	$ 16.00
2nd year	17.00
3rd year	18.00
1st year*	$ 16.39
2nd year*	17.44
3rd year*	18.54
1st year**	$ 18.50
2nd year**	19.50
3rd year**	20.50

*Note: Applies on New Construction & complete renovation
** Note: Applies when working on scaffolds over 34 feet.

Supplemental benefits:
Per hour:

1st year	$ 8.69
2nd year	8.69
3rd year	8.69

8-8A/28A-MP

Plumber 02/01/2024

JOB DESCRIPTION Plumber **DISTRICT** 11

ENTIRE COUNTIES
Orange, Rockland, Sullivan

PARTIAL COUNTIES
Ulster: Only the Townships of Plattekill, Marlboro, Wawarsing, and Shawangunk (except for Wallkill and Shawangunk Prisons).

WAGES
REFRIGERATION: For commercial and industrial refrigeration which means service, maintenance, and installation work where the combined compressor tonnage does not exceed 40 tons.
AIR CONDITIONING: Air conditioning to be installed that is water cooled shall not exceed 25 tons. This will include the piping of the component system and erection of water tower. Air conditioning that is air cooled shall not exceed 50 tons.

WAGES: (per hour)

	07/01/2023	05/01/2024 Additional	05/01/2025 Additional
Plumber	$ 38.59	$ 2.25*	$ 2.50*

*To be allocated at a later date

Star Certification: an additional $ 1.00 per hour over scale will be paid to all those who have Star Certification.

Shift Differential: When mandated by the governmental agency, an additional 15% premium will be paid for irregular work day or for 2nd and 3rd shift.

SUPPLEMENTAL BENEFITS
Per hour:
Journeyman
$ 36.07*

*For overtime or shift differential work, $0.10 is paid at straight time, the remaining balance is paid at the same premium as the wages.

OVERTIME PAY
See (B, G, P, *V) on OVERTIME PAGE
* A portion of the benefit amount is subject to the V code for overtime and shift differential work.

HOLIDAY
Paid: See (5, 6, 13, 15, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 13, 15, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
(1)year terms at the following wage.

	07/01/2023
1st term	$ 17.37
2nd term	21.23
3rd term	25.09
4th term	28.95
5th term	32.81

Supplemental Benefits per hour:
Apprentices

1st term	$ 16.31*
2nd term	19.90*
3rd term	23.50*
4th term	27.10*
5th term	30.69*

*For overtime or shift differential work, $0.10 is paid at straight time, the remaining balance is paid at the same premium as the wages.
11-373 Refrig

Plumber 02/01/2024

JOB DESCRIPTION Plumber **DISTRICT** 11

ENTIRE COUNTIES
Orange, Rockland, Sullivan

PARTIAL COUNTIES
Ulster: Only the Townships of Plattekill, Marlboro, Wawarsing, and Shawangunk (except for Wallkill and Shawangunk Prisons).

WAGES

WAGES:(per hour)	07/01/2023	05/01/2024 Additional
Plumber/Steamfitter	$ 49.95	$ 2.25*

*to be allocated at a later date

Note: For all work 40-60 feet above ground add $ 0.25 per hour, over 60 feet add $ 0.50 per hour.

Shift Differential: When mandated by the governmental agency, an additional 15% premium will be paid for irregular work day or for 2nd and 3rd shift.

SUPPLEMENTAL BENEFITS
Per hour:

Journeyman	$ 44.57

*For overtime or shift differential work, $0.10 is paid at straight time, the remaining balance is paid at the same premium as the wages.

OVERTIME PAY
See (B, E, Q, *V) on OVERTIME PAGE
* A portion of the benefit amount is subject to the V code for overtime and shift differential work.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 15, 16) on HOLIDAY PAGE
When a holiday falls on a Saturday, the day prior shall be considered and recognized as the holiday. When a holiday falls on a Sunday, the day proceeding shall be considered and recognized as the holiday to be observed.

REGISTERED APPRENTICES
(1) year terms at the following wages.

	07/01/2023
1st term	$ 17.49
2nd term	22.48
3rd term	27.48
4th term	32.47
5th term	39.96

Supplemental Benefits per hour:

1st term	$ 15.69*
2nd term	20.14*
3rd term	24.57*
4th term	29.03*
5th term	35.67*

*For overtime or shift differential work, $0.10 is paid at straight time, the remaining balance is paid at the same premium as the wages.
11-373 SF

Roofer 02/01/2024

JOB DESCRIPTION Roofer **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Dutchess, Kings, New York, Orange, Putnam, Queens, Richmond, Rockland, Sullivan, Ulster, Westchester

WAGES

Per Hour:	07/01/2023	05/01/2024 Additional
Roofer/Waterproofer	$ 46.50 + $7.00*	$2.50

* This portion is not subjected to overtime premiums.

Note: Abatement/Removal of Asbestos containing roofs and roofing material is classified as Roofer.

SUPPLEMENTAL BENEFITS
Per Hour: $ 31.37

OVERTIME PAY
See (B, H) on OVERTIME PAGE
Note: An observed holiday that falls on a Sunday will be observed the following Monday.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
(1) year term apprentices indentured prior to 01/01/2023

1st	2nd	3rd	4th
$ 16.28	$ 23.25	$ 27.90	$ 34.88
	+ 3.50*	+ 4.20*	+ 5.26*

Supplements:

1st	2nd	3rd	4th
$ 4.03	$ 15.85	$ 18.95	$ 23.61

* This portion is not subjected to overtime premiums.

(1) year term apprentices indentured after 01/01/2023

1st	2nd	3rd	4th	5th
$ 17.67	$ 20.93	$ 23.25	$ 27.90	$ 34.88
	+ 3.16*	+ 3.50*	+ 4.20*	+ 5.26

Supplements:

1st	2nd	3rd	4th	5th
$ 7.61	$ 14.29	$ 15.85	$ 18.95	$ 23.61

* This portion is not subjected to overtime premiums.

9-8R

Sheetmetal Worker — 02/01/2024

JOB DESCRIPTION Sheetmetal Worker **DISTRICT** 8

ENTIRE COUNTIES
Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester

WAGES

	07/01/2023
SheetMetal Worker	$ 47.00
	+ 3.60*

*This portion is not subject to overtime premiums.

SHIFT WORK
For all NYS D.O.T. and other Governmental mandated off-shift work:
10% increase for additional shifts for a minimum of five (5) days

SUPPLEMENTAL BENEFITS
Journeyworker $ 45.62

OVERTIME PAY
OVERTIME:.. See (B, E, Q,) on OVERTIME PAGE.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 16, 23) on HOLIDAY PAGE

REGISTERED APPRENTICES

1st	2nd	3rd	4th	5th	6th	7th	8th
$ 17.50	$ 19.67	$ 21.87	$ 24.05	$ 26.24	$ 28.44	$ 31.10	$ 33.75
+ 1.44*	+ 1.62*	+ 1.80*	+ 1.98*	+ 2.16*	+ 2.34*	+ 2.52*	+ 2.70*

*This portion is not subject to overtime premiums.

Supplemental Benefits per hour:

Apprentices	
1st term	$ 19.53
2nd term	21.99
3rd term	24.42

4th term	26.88
5th term	29.32
6th term	31.75
7th term	33.72
8th term	35.71

8-38

Sprinkler Fitter — 02/01/2024

JOB DESCRIPTION Sprinkler Fitter **DISTRICT** 1

ENTIRE COUNTIES
Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester

WAGES
Per hour 07/01/2023

Sprinkler Fitter	$ 50.86

SUPPLEMENTAL BENEFITS
Per hour

Journeyperson	$ 30.19

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6) on HOLIDAY PAGE
Note: When a holiday falls on Sunday, the following Monday shall be considered a holiday and all work performed on either day shall be at the double time rate. When a holiday falls on Saturday, the preceding Friday shall be considered a holiday and all work performed on either day shall be at the double time rate.

REGISTERED APPRENTICES
Wages per hour

One Half Year terms at the following wage.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$ 24.77	$ 27.53	$ 30.03	$ 32.78	$ 35.53	$ 38.29	$ 41.04	$ 43.79	$ 46.54	$ 49.30

Supplemental Benefits per hour

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
$ 8.74	$ 8.74	$ 20.32	$ 20.32	$ 20.57	$ 20.57	$ 20.57	$ 20.57	$ 20.57	$ 20.57

1-669.2

Teamster - Building / Heavy&Highway — 02/01/2024

JOB DESCRIPTION Teamster - Building / Heavy&Highway **DISTRICT** 11

ENTIRE COUNTIES
Dutchess, Orange, Rockland, Sullivan, Ulster

WAGES
GROUP 1: LeTourneau Tractors, Double Barrel Euclids, Athney Wagons and similar equipment (except when hooked to scrapers), I-Beam and Pole Trailers, Tire Trucks, Tractor and Trailers with 5 axles and over, Articulated Back Dumps and Road Oil Distributors, Articulated Water Trucks and Fuel Trucks/Trailers, positions requiring a HAZMAT CDL endorsement.

GROUP 1A: Drivers on detachable Gooseneck Low Bed Trailers rated over 35 tons.

GROUP 2: All equipment 25 yards and up to and including 30 yard bodies and cable Dump Trailers and Powder and Dynamite Trucks.

GROUP 3: All Equipment up to and including 24-yard bodies, Mixer Trucks, Dump Crete Trucks and similar types of equipment, Fuel Trucks, Batch Trucks and all other Tractor Trailers, Hi-Rail Truck.

GROUP 4: Tri-Axles, Ten Wheelers, Grease Trucks, Tillerman, Pattern Trucks, Attenuator Trucks, Water Trucks, Bus.

GROUP 5: Straight Trucks.

GROUP 6: Pick-up Trucks for hauling materials and parts, and Escort Man over-the-road.

WAGES: (per hour)	07/01/2023
GROUP 1	$ 34.58
GROUP 1A	35.72
GROUP 2	34.02
GROUP 3	33.80
GROUP 4	33.69
GROUP 5	33.57
GROUP 6	33.57

NOTE ADDITIONAL PREMIUMS:
- On projects requiring an irregular shift a premium of 10% will be paid on wages. The premium will be paid for off-shift or irregular shift work when mandated by Governmental Agency.
- Employees engaged in hazardous/toxic waste removal, on a State or Federally designated hazardous/toxic waste site, where the employee comes in contact with hazardous/toxic waste material and when personal protective equipment is required for respiratory, skin, or eye protection, the employee shall receive an additional 20% premium above the hourly wage.

NOTE - The 'Employer Registration' (30.1) use of a '4 Day/10 Hour Work schedules' will no longer be accepted or processed. All registered projects prior to June 30,2023 will expire within the granted time frame.

For Pre-Registered Projects Four (4), Ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day. Tuesday thru Friday may be worked with no make-up day. For further clarification contact your local Bureau Office.

SUPPLEMENTAL BENEFITS

Per hour:	
First 40 hours	$ 44.59
Over 40 hours	36.99

OVERTIME PAY
See (*B, E, **E2, ***P, X) on OVERTIME PAGE
*Holidays worked Monday through Friday receive Double Time (2x) after 8 hours.
**Makeup day limited to the employees who were working on the site that week.
***Sunday Holidays are paid at a rate of double time and one half (2.5x) for all hours worked.

HOLIDAY
Paid: See (5, 6, 15, 25) on HOLIDAY PAGE
Overtime: See (*1) on HOLIDAY PAGE
- Any employee working two (2) days in any calendar week during which a holiday occurs shall receive a days pay for each holiday occurring during said week. This provision shall also apply if a holiday falls on a Saturday or Sunday.
*See OVERTIME PAY section for when additional premium is applicable on Holiday hours worked.

11-445B/HH

Teamster - Delivery - Building / Heavy&Highway — 02/01/2024

JOB DESCRIPTION Teamster - Delivery - Building / Heavy&Highway **DISTRICT** 11

ENTIRE COUNTIES
Dutchess, Orange, Rockland, Sullivan, Ulster

WAGES

Group 1	Tractor Trailer Drivers
Group 2	Tri- Axle

Wages:	07/01/2023
Group 1	$ 33.70
Group 2	29.70

Hazardous/Toxic Waste Removal additional 20% when personal protective equipment is required.

SUPPLEMENTAL BENEFITS

Per hour paid:	
First 40 hours	$ 32.30
Over 40 hours	0.00

OVERTIME PAY
See (B, E, Q, X) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 13, 15, 16, 20, 22, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 13, 15, 16, 20, 22, 25, 26) on HOLIDAY PAGE
- Employee must work either the scheduled day of work before or the scheduled day of work after the holiday in the workweek.

- Any employee working one (1) day in the calendar week during which a holiday occurs shall receive a day's pay for each holiday occurring during said week. This provision shall also apply if a holiday falls on a Saturday.
- When any of the recognized holidays occur on Sunday and are celebrated any day before or after the holiday Sunday, such days shall be considered as the holiday and paid for as such.

11-445 B/HH Delivery

Welder 02/01/2024

JOB DESCRIPTION Welder **DISTRICT** 1

ENTIRE COUNTIES
Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES
Per hour 07/01/2023

Welder: To be paid the same rate of the mechanic performing the work.*

*EXCEPTION: If a specific welder certification is required, then the 'Certified Welder' rate in that trade tag will be paid.

OVERTIME PAY

HOLIDAY

1-As Per Trade

Overtime Codes

Following is an explanation of the code(s) listed in the OVERTIME section of each classification contained in the attached schedule. Additional requirements may also be listed in the HOLIDAY section.

NOTE: Supplemental Benefits are 'Per hour worked' (for each hour worked) unless otherwise noted

(AA)	Time and one half of the hourly rate after 7 and one half hours per day
(A)	Time and one half of the hourly rate after 7 hours per day
(B)	Time and one half of the hourly rate after 8 hours per day
(B1)	Time and one half of the hourly rate for the 9th & 10th hours week days and the 1st 8 hours on Saturday. Double the hourly rate for all additional hours
(B2)	Time and one half of the hourly rate after 40 hours per week
(C)	Double the hourly rate after 7 hours per day
(C1)	Double the hourly rate after 7 and one half hours per day
(D)	Double the hourly rate after 8 hours per day
(D1)	Double the hourly rate after 9 hours per day
(E)	Time and one half of the hourly rate on Saturday
(E1)	Time and one half 1st 4 hours on Saturday; Double the hourly rate all additional Saturday hours
(E2)	Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
(E3)	Between November 1st and March 3rd Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather, provided a given employee has worked between 16 and 32 hours that week
(E4)	Saturday and Sunday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
(E5)	Double time after 8 hours on Saturdays
(F)	Time and one half of the hourly rate on Saturday and Sunday
(G)	Time and one half of the hourly rate on Saturday and Holidays
(H)	Time and one half of the hourly rate on Saturday, Sunday, and Holidays
(I)	Time and one half of the hourly rate on Sunday
(J)	Time and one half of the hourly rate on Sunday and Holidays
(K)	Time and one half of the hourly rate on Holidays
(L)	Double the hourly rate on Saturday
(M)	Double the hourly rate on Saturday and Sunday
(N)	Double the hourly rate on Saturday and Holidays
(O)	Double the hourly rate on Saturday, Sunday, and Holidays
(P)	Double the hourly rate on Sunday
(Q)	Double the hourly rate on Sunday and Holidays
(R)	Double the hourly rate on Holidays
(S)	Two and one half times the hourly rate for Holidays

(S1) Two and one half times the hourly rate the first 8 hours on Sunday or Holidays One and one half times the hourly rate all additional hours.

(T) Triple the hourly rate for Holidays

(U) Four times the hourly rate for Holidays

(V) Including benefits at SAME PREMIUM as shown for overtime

(W) Time and one half for benefits on all overtime hours.

(X) Benefits payable on Paid Holiday at straight time. If worked, additional benefit amount will be required for worked hours. (Refer to other codes listed.)

Holiday Codes

PAID Holidays:

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

OVERTIME Holiday Pay:

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays. The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Following is an explanation of the code(s) listed in the HOLIDAY section of each classification contained in the attached schedule. The Holidays as listed below are to be paid at the wage rates at which the employee is normally classified.

(1)	None
(2)	Labor Day
(3)	Memorial Day and Labor Day
(4)	Memorial Day and July 4th
(5)	Memorial Day, July 4th, and Labor Day
(6)	New Year's, Thanksgiving, and Christmas
(7)	Lincoln's Birthday, Washington's Birthday, and Veterans Day
(8)	Good Friday
(9)	Lincoln's Birthday
(10)	Washington's Birthday
(11)	Columbus Day
(12)	Election Day
(13)	Presidential Election Day
(14)	1/2 Day on Presidential Election Day
(15)	Veterans Day
(16)	Day after Thanksgiving
(17)	July 4th
(18)	1/2 Day before Christmas
(19)	1/2 Day before New Years
(20)	Thanksgiving
(21)	New Year's Day
(22)	Christmas
(23)	Day before Christmas
(24)	Day before New Year's
(25)	Presidents' Day
(26)	Martin Luther King, Jr. Day
(27)	Memorial Day
(28)	Easter Sunday

(29) Juneteenth

New York State Department of Labor - Bureau of Public Work
State Office Building Campus
Building 12 - Room 130
Albany, New York 12226

REQUEST FOR WAGE AND SUPPLEMENT INFORMATION

As Required by Articles 8 and 9 of the NYS Labor Law

Fax (518) 485-1870 or mail this form for new schedules or for determination for additional occupations.

This Form Must Be Typed

Submitted By: (Check Only One) ☐ Contracting Agency ☐ Architect or Engineering Firm ☐ Public Work District Office Date:

A. Public Work Contract to be let by: (Enter Data Pertaining to Contracting/Public Agency)

1. Name and complete address ☐ (Check if new or change)

Telephone Fax

E-Mail:

2. NY State Units (see Item 5).

- ☐ 01 DOT
- ☐ 02 OGS
- ☐ 03 Dormitory Authority
- ☐ 04 State University Construction Fund
- ☐ 05 Mental Hygiene Facilities Corp.
- ☐ 06 OTHER N.Y. STATE UNIT
- ☐ 07 City
- ☐ 08 Local School District
- ☐ 09 Special Local District, i.e., Fire, Sewer, Water District
- ☐ 1O Village
- ☐ 11 Town
- ☐ 12 County
- ☐ 13 Other Non-N.Y. State (Describe)

3. SEND REPLY TO ☐ (check if new or change)
Name and complete address:

Telephone Fax

E-Mail:

4. SERVICE REQUIRED. Check appropriate box and provide project information.

☐ New Schedule of Wages and Supplements.

APPROXIMATE BID DATE :

☐ Additional Occupation and/or Redetermination

PRC NUMBER ISSUED PREVIOUSLY FOR THIS PROJECT :

OFFICE USE ONLY

B. PROJECT PARTICULARS

5. Project Title _____

Description of Work _____

_____

Contract Identification Number _____

Note: For NYS units, the OSC Contract No. _____

6. Location of Project:
Location on Site _____

Route No/Street Address _____

Village or City _____

Town _____

County _____

7. Nature of Project - Check One:

- ☐ 1. New Building
- ☐ 2. Addition to Existing Structure
- ☐ 3. Heavy and Highway Construction (New and Repair)
- ☐ 4. New Sewer or Waterline
- ☐ 5. Other New Construction (Explain)
- ☐ 6. Other Reconstruction, Maintenance, Repair or Alteration
- ☐ 7. Demolition
- ☐ 8. Building Service Contract

8. OCCUPATION FOR PROJECT :

- ☐ Construction (Building, Heavy Highway/Sewer/Water)
- ☐ Tunnel
- ☐ Residential
- ☐ Landscape Maintenance
- ☐ Elevator maintenance
- ☐ Exterminators, Fumigators
- ☐ Fire Safety Director, NYC Only
- ☐ Fuel Delivery
- ☐ Guards, Watchmen
- ☐ Janitors, Porters, Cleaners, Elevator Operators
- ☐ Moving furniture and equipment
- ☐ Trash and refuse removal
- ☐ Window cleaners
- ☐ Other (Describe)

9. Does this project comply with the Wicks Law involving separate bidding? YES ☐ NO ☐

10. Name and Title of Requester

Signature

SEE PAGE TWO FOR LAWS RELATING TO PUBLIC WORK CONTRACTS

NEW YORK STATE DEPARTMENT OF LABOR
Bureau of Public Work - Debarment List

LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE AWARDED ANY PUBLIC WORK CONTRACT

Under Article 8 and Article 9 of the NYS Labor Law, a contractor, sub-contractor and/or its successor shall be debarred and ineligible to submit a bid on or be awarded any public work or public building service contract/sub-contract with the state, any municipal corporation or public body for a period of five (5) years from the date of debarment when:

- Two (2) final determinations have been rendered within any consecutive six-year (6) period determining that such contractor, sub-contractor and/or its successor has WILLFULLY failed to pay the prevailing wage and/or supplements;
- One (1) final determination involves falsification of payroll records or the kickback of wages and/or supplements.

The agency issuing the determination and providing the information, is denoted under the heading 'Fiscal Officer'. DOL = New York State Department of Labor; NYC = New York City Comptroller's Office; AG = New York State Attorney General's Office; DA = County District Attorney's Office.

Debarment Database: To search for contractors, sub-contractors and/or their successors debarred from bidding or being awarded any public work contract or subcontract under NYS Labor Law Articles 8 and 9, or under NYS Workers' Compensation Law Section 141-b, access the database at this link: https://apps.labor.ny.gov/EDList/searchPage.do

For inquiries where WCB is listed as the "Agency", please call 1-866-546-9322

NYSDOL Bureau of Public Work Debarment List 02/23/2024

Article 8

AGENCY	Fiscal Officer	FEIN	EMPLOYER NAME	EMPLOYER DBA NAME	ADDRESS	DEBARMENT START DATE	DEBARMENT END DATE
DOL	DOL	*****5754	0369 CONTRACTORS, LLC		515 WEST AVE UNIT PH 13NORWALK CT 06850	05/12/2021	05/12/2026
DOL	DOL	*****4018	ADIRONDACK BUILDING RESTORATION INC.		4156 WILSON ROAD EAST TABERG NY 13471	03/26/2019	03/26/2024
DOL	AG	*****1812	ADVANCED BUILDERS & LAND DEVELOPMENT, INC.		400 OSER AVE #2300HAUPPAUGE NY 11788	09/11/2019	09/11/2024
DOL	DOL	*****1687	ADVANCED SAFETY SPRINKLER INC		261 MILL ROAD P.O BOX 296EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	NYC		ALL COUNTY SEWER & DRAIN, INC.		7 GREENFIELD DR WARWICK NY 10990	03/25/2022	03/25/2027
DOL	NYC		AMJED PARVEZ		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL		ANGELO F COKER		2610 SOUTH SALINA STREET SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		ANGELO GARCIA		515 WEST AVE UNIT PH 13NORWALK CT 06850	05/12/2021	05/12/2026
DOL	DOL		ANGELO TONDO		449 WEST MOMBSHA ROAD MONROE NY 10950	06/06/2022	06/06/2027
DOL	DOL	*****4231	ANKER'S ELECTRIC SERVICE, INC.		10 SOUTH 5TH ST LOCUST VALLEY NY 11560	09/26/2022	09/26/2027
DOL	NYC		ARADCO CONSTRUCTION CORP		115-46 132RD ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	DOL		ARNOLD A. PAOLINI		1250 BROADWAY ST BUFFALO NY 14212	02/03/2020	02/03/2025
DOL	NYC		ARSHAD MEHMOOD		168-42 88TH AVENUE JAMAICA NY 11432	11/20/2019	11/20/2024
DOL	NYC		AVM CONSTRUCTION CORP		117-72 123RD ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	NYC		AZIDABEGUM		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DOL	*****8421	B & B DRYWALL, INC		206 WARREN AVE APT 1WHITE PLAINS NY 10603	12/14/2021	12/14/2026
DOL	DOL		BERNARD BEGLEY		38 LONG RIDGE ROAD BEDFORD NY 10506	12/18/2019	12/18/2024
DOL	NYC	*****2113	BHW CONTRACTING, INC.		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL	*****3627	BJB CONSTRUCTION CORP.		38 LONG RIDGE ROAD BEDFORD NY 10506	12/18/2019	12/18/2024
DOL	DOL	*****5078	BLACK RIVER TREE REMOVAL, LLC		29807 ANDREWS ROAD BLACK RIVER NY 13032	10/17/2023	10/17/2028
DOL	DOL	*****4512	BOB BRUNO EXCAVATING, INC		5 MORNINGSIDE DR AUBURN NY 13021	05/28/2019	05/28/2024
DOL	DOL		BRADLEY J SCHUKA		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	DOL	*****9383	C.C. PAVING AND EXCAVATING, INC.		2610 SOUTH SALINA ST SUITE 12SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL	*****4083	C.P.D. ENTERPRISES, INC		P.O BOX 281 WALDEN NY 12586	03/03/2020	03/03/2025
DOL	DOL	*****5161	CALADRI DEVELOPMENT CORP.		1223 PARK ST. PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	DOL	*****3391	CALI ENTERPRISES, INC.		1223 PARK STREET PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	NYC		CALVIN WALTERS		465 EAST THIRD ST MT. VERNON NY 10550	09/09/2019	09/09/2024
DOL	DOL	*****4155	CASA BUILDERS, INC.	FRIEDLANDER CONSTRUCTION	64 N PUTT CONNERS ROAD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	AG	*****7247	CENTURY CONCRETE CORP		2375 RAYNOR ST RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****0026	CHANTICLEER CONSTRUCTION LLC		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	NYC	*****2117	CHARAN ELECTRICAL ENTERPRISES		9-11 40TH AVENUE LONG ISLAND CITY NY 11101	09/26/2023	09/26/2028
DOL	NYC		CHARLES ZAHRADKA		863 WASHINGTON STREET FRANKLIN SQUARE NY 11010	03/10/2020	03/10/2025
DOL	DOL		CHRISTOPHER GRECO		26 NORTH MYRTLE AVENUE SPRING VALLEY NY 10956	02/18/2021	02/18/2026

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DOL	DOL		CHRISTOPHER PAPASTEFANOU A/K/A CHRIS PAPASTEFANOU		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL		CRAIG JOHANSEN		10 SOUTH 5TH ST LOCUST VALLEY NY 11560	09/26/2022	09/26/2027
DOL	DOL	*****3228	CROSS-COUNTY LANDSCAPING AND TREE SERVICE, INC.	ROCKLAND TREE SERVICE	26 NORTH MYRTLE AVENUE SPRING VALLEY NY 10956	02/18/2021	02/18/2026
DOL	DOL	*****7619	DANCO CONSTRUCTION UNLIMITED INC.		485 RAFT AVENUE HOLBROOK NY 11741	10/19/2021	10/19/2026
DOL	DOL		DANIEL ROBERT MCNALLY		7 GREENFIELD DRIVE WARWICK NY 10990	03/25/2022	03/25/2027
DOL	DOL		DARIAN L COKER		2610 SOUTH SALINA ST SUITE 2CSYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		DAVID FRIEDLANDER		64 NORTH PUTT CORNERS RD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	NYC		DAVID WEINER		14 NEW DROP LANE 2ND FLOORSTATEN ISLAND NY 10306	11/14/2019	11/14/2024
DOL	DOL		DELPHI PAINTING & DECORATING CO INC		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL		DINA TAYLOR		64 N PUTT CONNERS RD NEW PALTZ NY 12561	05/10/2023	05/10/2028
DOL	DOL	*****5175	EAGLE MECHANICAL AND GENERAL CONSTRUCTION LLC		11371 RIDGE RD WOLCOTT NY 14590	02/03/2020	02/03/2025
DOL	AG		EDWIN HUTZLER		23 NORTH HOWELLS RD BELLPORT NY 11713	08/04/2021	08/04/2026
DOL	DA		EDWIN HUTZLER		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****0780	EMES HEATING & PLUMBING CONTR		5 EMES LANE MONSEY NY 10952	01/20/2002	01/20/3002
DOL	NYC	*****5917	EPOCH ELECTRICAL, INC		97-18 50TH AVE CORONA NY 11368	04/19/2018	04/19/2024
DOL	DOL		EUGENIUSZ "GINO" KUCHAR		195 KINGSLAND AVE BROOKLYN NY 11222	12/22/2023	12/22/2028
DOL	DOL		FAIGY LOWINGER		11 MOUNTAIN RD 28 VAN BUREN DRMONROE NY 10950	03/20/2019	03/20/2024
DOL	DA		FREDERICK HUTZLER		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	NYC	*****6616	G & G MECHANICAL ENTERPRISES, LLC.		1936 HEMPSTEAD TURNPIKE EAST MEDOW NY 11554	11/29/2019	11/29/2024
DOL	DOL	*****2998	G.E.M. AMERICAN CONSTRUCTION CORP.		195 KINGSLAND AVE BROOKLYN NY 11222	12/22/2023	12/22/2028
DOL	DOL		GABRIEL FRASSETTI			04/10/2019	04/10/2024
DOL	NYC		GAYATRI MANGRU		21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	DA		GEORGE LUCEY		150 KINGS STREET BROOKLYN NY 11231	01/19/1998	01/19/2998
DOL	DOL		GIGI SCHNECKENBURGER		261 MILL RD EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	DA		GIOVANNA TRAVALJA		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	DA	*****0213	GORILLA CONTRACTING GROUP, LLC		505 MANHATTAN AVE WEST BABYLON NY 11704	10/05/2023	10/05/2028
DOL	DOL		HANS RATH		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	DOL		HERBERT CLEMEN		42 FOWLER AVENUE CORTLAND MANOR NY 10567	01/24/2023	01/24/2028
DOL	DOL		HERBERT CLEMEN		42 FOWLER AVENUE CORTLAND MANOR NY 10567	10/25/2022	10/25/2027
DOL	DOL		IRENE KASELIS		32 PENNINGTON AVE WALDWICK NJ 07463	05/30/2019	05/30/2024
DOL	DOL	*****9211	J. WASE CONSTRUCTION CORP.		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	DOL		J.M.J CONSTRUCTION		151 OSTRANDER AVENUE SYRACUSE NY 13205	11/21/2022	11/21/2027
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		J.R. NELSON CONSTRUCTION		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027

DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R. NELSON, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	12/12/2022	12/12/2027
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		J.R.N COMPANIES, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL	*****1147	J.R.N. CONSTRUCTION, LLC		531 THIRD ST ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		JAMES J. BAKER		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL		JASON P. RACE		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL	*****7993	JBS DIRT, INC.		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL	*****2435	JEFFEL D. JOHNSON	JMJ7 AND SON	5553 CAIRNSTRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JEFFEL JOHNSON ELITE CARPENTER REMODEL AND CONSTRUCTION		C2 EVERGREEN CIRCLE LIVERPOOL NY 13090	11/21/2022	11/21/2027
DOL	DOL	*****2435	JEFFREY M. JOHNSON	JMJ7 AND SON	5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	NYC		JENNIFER GUERRERO		1936 HEMPSTEAD TURNPIKE EAST MEADOW NY 11554	11/29/2019	11/29/2024
DOL	DOL		JIM PLAUGHER		17613 SANTE FE LINE ROAD WAYNEFIELD OH 45896	07/16/2021	07/16/2026
DOL	DOL		JMJ7 & SON CONSTRUCTION, LLC		5553 CAIRNS TRAIL LIVERPOOL NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 AND SONS CONTRACTORS		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS		7014 13TH AVENUE BROOKLYN NY 11228	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS AND SONS		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JMJ7 CONTRACTORS, LLC		5553 CAIRNS TRAIL CLAY NY 13041	11/21/2022	11/21/2027
DOL	DOL		JOHN GOCEK		14B COMMERCIAL AVE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL		JOHN MARKOVIC		47 MANDON TERRACE HAWTHORN NJ 07506	03/29/2021	03/29/2026
DOL	DOL		JOHN WASE		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	DOL		JON E DEYOUNG		261 MILL RD P.O BOX 296EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	DOL		JORGE RAMOS		8970 MIKE GARCIA DR MANASSAS VA 20109	07/16/2021	07/16/2026
DOL	DOL		JOSEPH K. SALERNO		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL		JOSEPH K. SALERNO II		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026
DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027

DOL	DOL	*****5116	JP RACE PAINTING, INC. T/A RACE PAINTING		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL		JRN CONSTRUCTION CO, LLC		1024 BROADWAY ALBANY NY 12204	11/07/2023	11/07/2028
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL	*****1147	JRN CONSTRUCTION, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		JRN PAVING, LLC		531 THIRD STREET ALBANY NY 12206	11/07/2023	11/07/2028
DOL	DOL		JULIUS AND GITA BEHREND		5 EMES LANE MONSEY NY 10952	11/20/2002	11/20/3002
DOL	DOL		KARIN MANGIN		796 PHELPS ROAD FRANKLIN LAKES NJ 07417	12/01/2020	12/01/2025
DOL	DOL		KATE E. CONNOR		7088 INTERSTATE ISLAND RD SYRACUSE NY 13209	03/31/2021	03/31/2026
DOL	DOL		KEAN INDUSTRIES, LLC		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL	*****2959	KELC DEVELOPMENT, INC		7088 INTERSTATE ISLAND RD SYRACUSE NY 13209	03/31/2021	03/31/2026
DOL	DOL		KIMBERLY F. BAKER		7901 GEE ROAD CANASTOTA NY 13032	08/17/2021	08/17/2026
DOL	DOL		KMA GROUP II, INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL	*****1833	KMA GROUP INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL		KMA INSULATION, INC.		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028
DOL	DOL		KRIN HEINEMANN		2345 ROUTE 52, SUITE 2N HOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	NYC		KULWANT S. DEOL		9-11 40TH AVENUE LONG ISLAND CITY NY 11101	09/26/2023	09/26/2028
DOL	DA	*****8816	LAKE CONSTRUCTION AND DEVELOPMENT CORPORATION		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	10/25/2022	10/25/2027
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	12/22/2022	12/22/2027
DOL	DOL		LEROY E. NELSON JR		531 THIRD ST ALBANY NY 12206	11/07/2023	11/07/2028
DOL	AG	*****3291	LINTECH ELECTRIC, INC.		3006 TILDEN AVE BROOKLYN NY 11226	02/16/2022	02/16/2027
DOL	DOL		LOUIS A. CALICCHIA		1223 PARK ST. PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	NYC		LUBOMIR PETER SVOBODA		27 HOUSMAN AVE STATEN ISLAND NY 10303	12/26/2019	12/26/2024
DOL	NYC		M & L STEEL & ORNAMENTAL IRON CORP.		27 HOUSMAN AVE STATEN ISLAND NY 10303	12/26/2019	12/26/2024
DOL	DOL	*****2196	MAINSTREAM SPECIALTIES, INC.		11 OLD TOWN RD SELKIRK NY 12158	02/02/2021	02/02/2026
DOL	DA		MANUEL P TOBIO		150 KINGS STREET BROOKLYN NY 14444	08/19/1998	08/19/2998
DOL	DA		MANUEL TOBIO		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	NYC		MARIA NUBILE		84-22 GRAND AVENUE ELMHURST NY 11373	03/10/2020	03/10/2025
DOL	DOL		MATTHEW P. KILGORE		4156 WILSON ROAD EAST TABERG NY 13471	03/26/2019	03/26/2024
DOL	DOL	*****4829	MILESTONE ENVIRONMENTAL CORPORATION		704 GINESI DRIVE SUITE 29MORGANVILLE NJ 07751	04/10/2019	04/10/2024
DOL	NYC	*****9926	MILLENNIUM FIRE PROTECTION, LLC		325 W. 38TH STREET SUITE 204NEW YORK NY 10018	11/14/2019	11/14/2024
DOL	NYC	*****0627	MILLENNIUM FIRE SERVICES, LLC		14 NEW DROP LNE 2ND FLOORSTATEN ISLAND NY 10306	11/14/2019	11/14/2024

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DOL	DOL	*****1320	MJC MASON CONTRACTING, INC.		42 FOWLER AVENUE CORTLAND MANOR NY 10567	10/25/2022	10/25/2027
DOL	DOL	*****1320	MJC MASON CONTRACTING, INC.		42 FOWLER AVENUE CORTLAND MANOR NY 10567	01/24/2023	01/24/2028
DOL	NYC		MUHAMMED A. HASHEM		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	NYC		NAMOW, INC.		84-22 GRAND AVENUE ELMHURST NY 11373	03/10/2020	03/10/2025
DOL	DOL	*****7790	NATIONAL BUILDING & RESTORATION CORP		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	DOL	*****1797	NATIONAL CONSTRUCTION SERVICES, INC		1010 TILDEN AVE UTICA NY 13501	07/24/2023	07/24/2028
DOL	NYC		NAVIT SINGH		402 JERICHO TURNPIKE NEW HYDE PARK NY 11040	08/10/2022	08/10/2027
DOL	DOL		NELCO CONTRACTING, LLC		1024 BROADWAY ALBANY NY 12204	11/07/2023	11/07/2028
DOL	DA		NICHOLAS T. ANALITIS		505 MANHATTAN AVE WEST BABYLON NY 11704	10/05/2023	10/05/2028
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	03/01/2022	03/01/2027
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	11/15/2022	11/15/2027
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	09/29/2021	09/29/2026
DOL	DOL		NICHOLE E. FRASER A/K/A NICHOLE RACE		3469 STATE RT. 69 PERISH NY 13131	02/09/2022	02/09/2027
DOL	DOL	*****7429	NICOLAE I. BARBIR	BESTUCCO CONSTRUCTION, INC.	444 SCHANTZ ROAD ALLENTOWN PA 18104	09/17/2020	09/17/2025
DOL	NYC	*****5643	NYC LINE CONTRACTORS, INC.		402 JERICHO TURNPIKE NEW HYDE PARK NY 11040	08/10/2022	08/10/2027
DOL	DOL		PATRICK PENNACCHIO		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL		PATRICK PENNACCHIO		2345 RT. 52 SUITE 2NHOPEWELL JUNCTION NY 12533	12/18/2023	12/18/2028
DOL	DOL		PAULINE CHAHALES		935 S LAKE BLVD MAHOPAC NY 10541	03/02/2021	03/02/2026
DOL	DOL		PETER STEVENS		11 OLD TOWN ROAD SELKIRK NY 12158	02/02/2021	02/02/2026
DOL	DOL		PETER STEVENS		8269 21ST ST BELLEROSE NY 11426	12/22/2022	12/22/2027
DOL	DOL	*****0466	PRECISION BUILT FENCES, INC.		1617 MAIN ST PEEKSKILL NY 10566	03/03/2020	03/03/2025
DOL	NYC		RASHEL CONSTRUCTION CORP		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DOL	*****1068	RATH MECHANICAL CONTRACTORS, INC.		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	DOL	*****2633	RAW POWER ELECTRIC CORP.		3 PARK CIRCLE MIDDLETOWN NY 10940	07/11/2022	07/11/2027
DOL	DA	*****7559	REGAL CONTRACTING INC.		24 WOODBINE AVE NORTHPORT NY 11768	10/01/2020	10/01/2025
DOL	DOL		RICHARD REGGIO		1617 MAIN ST PEEKSKILL NY 10566	03/03/2020	03/03/2025
DOL	DOL		ROBBYE BISSESAR		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	01/11/2003	01/11/3003
DOL	DOL		ROBERT A. VALERINO		3841 LANYARD COURT NEW PORT RICHEY FL 34652	07/09/2019	07/09/2024
DOL	DOL		ROBERT BRUNO		5 MORNINGSIDE DRIVE AUBURN NY 13021	05/28/2019	05/28/2024
DOL	DOL		ROMEO WARREN		161 ROBYN RD MONROE NY 10950	07/11/2022	07/11/2027
DOL	DOL		RONALD MESSEN		14B COMMERCIAL AVE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL	*****7172	RZ & AL INC.		198 RIDGE AVENUE VALLEY STREAM NY 11581	06/06/2022	06/06/2027
DOL	DOL	*****1365	S & L PAINTING, INC.		11 MOUNTAIN ROAD P.O BOX 408MONROE NY 10950	03/20/2019	03/20/2024
DOL	DOL		SAL FRESINA MASONRY CONTRACTORS, INC.		1935 TEALL AVENUE SYRACUSE NY 13206	07/16/2021	07/16/2026
DOL	DOL		SAL MASONRY CONTRACTORS, INC.		(SEE COMMENTS) SYRACUSE NY 13202	07/16/2021	07/16/2026

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DOL	DOL	*****9874	SALFREE ENTERPRISES INC		P.O BOX 14 2821 GARDNER RDPOMPEI NY 13138	07/16/2021	07/16/2026
DOL	DOL		SALVATORE A FRESINA A/K/A SAM FRESINA		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13218	07/16/2021	07/16/2026
DOL	DOL		SAM FRESINA		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13218	07/16/2021	07/16/2026
DOL	NYC	*****0349	SAM WATERPROOFING INC		168-42 88TH AVENUE APT.1 AJAMAICA NY 11432	11/20/2019	11/20/2024
DOL	DA	*****0476	SAMCO ELECTRIC CORP.		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	NYC	*****1130	SCANA CONSTRUCTION CORP.		863 WASHINGTON STREET FRANKLIN SQUARE NY 11010	03/10/2020	03/10/2025
DOL	DOL	*****2045	SCOTT DUFFIE	DUFFIE'S ELECTRIC, INC.	P.O BOX 111 CORNWALL NY 12518	03/03/2020	03/03/2025
DOL	DOL		SCOTT DUFFIE		P.O BOX 111 CORNWALL NY 12518	03/03/2020	03/03/2025
DOL	DOL		SHULEM LOWINGER		11 MOUNTAIN ROAD 28 VAN BUREN DRMONROE NY 10950	03/20/2019	03/20/2024
DOL	DA		SILVANO TRAVALJA		3735 9TH ST LONG ISLAND CITY NY 11101	01/05/2023	01/05/2028
DOL	DOL	*****0440	SOLAR GUYS INC.		8970 MIKE GARCIA DR MANASSAS VA 20109	07/16/2021	07/16/2026
DOL	NYC		SOMATIE RAMSUNAHAI		115-46 132ND ST SOUTH OZONE PARK NY 11420	09/17/2020	09/17/2025
DOL	DOL	*****2221	SOUTH BUFFALO ELECTRIC, INC.		1250 BROADWAY ST BUFFALO NY 14212	02/03/2020	02/03/2025
DOL	NYC	*****3661	SPANIER BUILDING MAINTENANCE CORP		200 OAK DRIVE SYOSSET NY 11791	03/14/2022	03/14/2027
DOL	DOL		STANADOS KALOGELAS		485 RAFT AVENUE HOLBROOK NY 11741	10/19/2021	10/19/2026
DOL	DOL	*****3496	STAR INTERNATIONAL INC		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	08/11/2003	08/11/3003
DOL	DOL	*****6844	STEAM PLANT AND CHX SYSTEMS INC.		14B COMMERCIAL AVENUE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL	*****9933	STEED GENERAL CONTRACTORS, INC.		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL	*****9528	STEEL-IT, LLC.		17613 SANTE FE LINE ROAD WAYNESFIELD OH 45896	07/16/2021	07/16/2026
DOL	DOL		STEFANOS PAPASTEFANOU, JR. A/K/A STEVE PAPASTEFANOU, JR.		256 WEST SADDLE RIVER RD UPPER SADDLE RIVER NJ 07458	05/30/2019	05/30/2024
DOL	DOL	*****3800	SUBURBAN RESTORATION CO. INC.		5-10 BANTA PLACE FAIR LAWN PLACE NJ 07410	03/29/2021	03/29/2026
DOL	DOL	*****9150	SURGE INC.		8269 21ST STREET BELLEROSE NY 11426	12/22/2022	12/22/2027
DOL	DOL		SYED RAZA		198 RIDGE AVENUE NY 11581	06/06/2022	06/06/2027
DOL	DOL		TERRY THOMPSON		11371 RIDGE RD WOLCOTT NY 14590	02/03/2020	02/03/2025
DOL	DOL	*****9733	TERSAL CONSTRUCTION SERVICES INC		107 FACTORY AVE P.O BOX 11070SYRACUSE NY 13208	07/16/2021	07/16/2026
DOL	DOL		TERSAL CONTRACTORS, INC.		221 GARDNER RD P.O BOX 14POMPEI NY 13138	07/16/2021	07/16/2026
DOL	DOL		TERSAL DEVELOPMENT CORP.		1935 TEALL AVENUE SYRACUSE NY 13206	07/16/2021	07/16/2026
DOL	DOL	*****5766	THE COKER CORPORATION	COKER CORPORATIO N	2610 SOUTH SALINA ST SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		TIMOTHY PERCY		29807 ANDREWS ROAD BLACK RIVER NY 13612	10/17/2023	10/17/2028
DOL	DA	*****1050	TRI STATE CONSTRUCTION OF NY CORP.		50-39 175TH PLACE FRESH MEADOWS NY 11365	03/28/2022	03/28/2027
DOL	DA	*****4106	TRIPLE H CONCRETE CORP		2375 RAYNOR STREET RONKONKOMA NY 11779	08/04/2021	08/04/2026
DOL	DOL	*****8210	UPSTATE CONCRETE & MASONRY CONTRACTING CO INC		449 WEST MOMBSHA ROAD MONROE NY 10950	06/06/2022	06/06/2027
DOL	DOL	*****6418	VALHALLA CONSTRUCTION, LLC.		796 PHLEPS ROAD FRANKLIN LAKES NJ 07417	12/01/2020	12/01/2025

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Article 8

DOL	NYC	*****2426	VICKRAM MANGRU	VICK CONSTRUCTION	21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	NYC		VICKRAM MANGRU		21 DAREWOOD LANE VALLEY STREAM NY 11581	09/17/2020	09/17/2025
DOL	DOL		VIKTORIA RATH		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	NYC	*****3673	WALTERS AND WALTERS, INC.		465 EAST AND THIRD ST MT. VERNON NY 10550	09/09/2019	09/09/2024
DOL	DOL	*****3296	WESTERN NEW YORK CONTRACTORS, INC.		3841 LAYNARD COURT NEW PORT RICHEY FL 34652	07/09/2019	07/09/2024
DOL	DOL	*****8266	WILLIAM CHRIS MCCLENDON	MCCLENDON ASPHALT PAVING	1646 FALLS STREET NIAGARA FALLS NY 14303	05/01/2023	05/01/2028
DOL	DOL		WILLIAM CHRIS MCCLENDON		1646 FALLS STREET NIAGARA FALLS NY 14303	05/01/2023	05/01/2028
DOL	DOL		WILLIAM G. PROERFRIEDT		85 SPRUCEWOOD ROAD WEST BABYLON NY 11704	01/19/2021	01/19/2026
DOL	DOL	*****5924	WILLIAM G. PROPHY, LLC	WGP CONTRACTING, INC.	54 PENTAQUIT AVE BAYSHORE NY 11706	01/19/2021	01/19/2026
DOL	DOL		XENOFON EFTHIMIADIS		29-10 38TH AVENUE LONG ISLAND CITY NY 11101	10/11/2023	10/11/2028

SECTION 011000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS/REQUIREMENTS INCLUDES:

A. Work of items listed below is comprised of the following:

1. Contract #4.1603.2 – HVAC Direct Replacement for Thrall Library

1. Project Location: **11-19 Depot Street, Middletown, NY 10940**

C. Engineer: LAN Associates, Engineering, Planning, Architecture, Surveying, Inc.

D. The Work consists of the following:

1. Replace three (3) air-handling units (AHU's) and condensing units with similar capacity and air flow. Each air-handling unit will have variable air flow with a mixing box, MERV-13 filters, hot water heating coils, DX cooling coils, and a supply fan. The existing supply, return, outside air ductwork and hot water piping shall be reconnected to the new air-handling units.

2. Remove supply air plenum at the discharge of AHU-1 at the 2nd Floor Mezzanine Level and reconfigure the supply ductwork routing to the 2nd Floor to reduce the static pressure of the system.

3. Replace twenty-two (22) existing fan-powered and non-fan-powered VAV boxes through-out the building along with the hot water reheat coils.

4. Replace 3-way hot water control valves with 2-way modulating control valves for the air-handling units and reheat hot water.

5. Replace inoperable relief fan with variable speed fan on the upper roof.

6. Replace fan-powered box located in the crawlspace with a VAV box with hot water reheat coils.

7. Insulate crawlspace under the original building and/or install electric unit heater(s) for space heating.

8. Provide additional return grilles throughout the library to allow for proper air circulation.

9. Provide new DDC controls and web-based Building Management System (BMS) to control, monitor, and provide alarms for all new HVAC equipment and existing heating plant. The web-based BMS will allow users to access the system remotely to monitor and control the system from any web-enabled device (computer, laptop, tablet, etc).

F. Contractor's Duties:

1. Except as specifically noted, provide and pay for:

a. Labor, materials, and equipment;

b. Tools, construction equipment, and machinery;

c. City water, heat, utilities, etc. required for construction;

d. Other facilities and services necessary for proper execution and completion of work.

2. Secure and pay for, as necessary, proper execution and completion of work, and as applicable, at time of receipt of bids:

a. Permits including elevator inspection permits;
b. Government Fees;
c. Licenses;
d. Inspections of all work.

3. Give required notices to all governmental agencies and utilities;

4. Comply with codes, ordinances, regulations, rules, orders and other legal requirements of public authorities which bear on performance of work.

5. Promptly submit written notice to Engineer of observed variance of Contract Documents from legal requirements:

a. Appropriate modification to Contract Documents will adjust necessary changes;

b. Assume responsibility for work known to be contrary to such requirements when above notice has not been given.

1.2 CONTRACT:

A. Perform all work under a single lump sum/fixed price contract with Owner for work listed below and on drawings listed herein;

B. Work is fully described on drawings and in this specification. A detailed description of work included for these contracts can be found in various sections of this specification.

END OF SECTION 011000

SECTION 012500 – SUBSTITUTION PROCEDURES

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 substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use Company letter head.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication, or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and

separate contractors, that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from [**ICC-ES**] <**Insert applicable code organization**>.

j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within ten (10) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within ten (10) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than ten (10) days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.

b. Requested substitution provides sustainable design characteristics that specified product provided.

c. Substitution request is fully documented and properly submitted.

d. Requested substitution will not adversely affect Contractor's construction schedule.

e. Requested substitution has received necessary approvals of authorities having jurisdiction.

f. Requested substitution is compatible with other portions of the Work.

g. Requested substitution has been coordinated with other portions of the Work.

h. Requested substitution provides specified warranty.

i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is

uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within fourteen (14) days the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

b. Requested substitution does not require extensive revisions to the Contract Documents.

c. Requested substitution is consistent with the Contract Documents and will produce indicated results.

d. Requested substitution provides sustainable design characteristics that specified product provided.

e. Substitution request is fully documented and properly submitted.

f. Requested substitution will not adversely affect Contractor's construction schedule.

g. Requested substitution has received necessary approvals of authorities having jurisdiction.

h. Requested substitution is compatible with other portions of the Work.

i. Requested substitution has been coordinated with other portions of the Work.

j. Requested substitution provides specified warranty.

k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 013100 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Drawings.

2. Administrative and supervisory personnel.

3. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

C. Related Sections include the following:

1. Division 1 Section "Submittal Procedures" for Administrative and Procedural Requirements for submitting Shop Drawings.

2. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

1.03 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.

2. Preparation of the Schedule of Values.

3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.

5. Progress meetings.

6. Preinstallation conferences.

7. Startup and adjustment of systems.

8. Project closeout activities.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.04 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

b. Indicate required installation sequences.

c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Sheet Size: At least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).

3. Number of Copies: Submit five (5) copies where Coordination Drawings are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.

4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

B. Key Personnel Names: Within fourteen (14) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.05 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

1.06 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner, DPMC Manager and Architect, but no later than seven (7) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, DPMC Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.

b. Phasing.

c. Critical work sequencing and long-lead items.

d. Designation of key personnel and their duties.

e. Procedures for processing field decisions and Change Orders.

f. Procedures for requests for interpretations (RFIs).

g. Procedures for testing and inspecting.

h. Procedures for processing Applications for Payment.

i. Distribution of the Contract Documents.

j. Submittal procedures.

k. Use of the premises.

l. Work restrictions.

m. Owner's occupancy requirements.

n. Responsibility for temporary facilities and controls.

o. Construction waste management and recycling.

p. Parking availability.

q. Office, work, and storage areas.

r. Equipment deliveries and priorities.

s. First aid.

t. Security.

u. Progress cleaning.

v. Working hours.

3. Minutes: Architect will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and DPMC Construction Representative of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. The Contract Documents.
    b. Options.
    c. Related requests for interpretations (RFIs).
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility problems.
    k. Time schedules.
    l. Manufacturer's written recommendations.
    m. Warranty requirements.
    n. Temporary facilities and controls.
    o. Space and access limitations.
    p. Regulations of authorities having jurisdiction.
    q. Testing and inspecting requirements.
    r. Installation procedures.
    s. Coordination with other work.
    t. Required performance results.
    u. Protection of adjacent work.
    v. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at biweekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of DPMC, and Architect, each contractor, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) Requests for interpretations (RFIs).
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

3. Minutes: Architect will record and distribute to Contractor the meeting minutes.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

    a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 – CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.

2. Construction schedule updating reports.

3. Daily construction reports.

4. Site condition reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.

2. Predecessor Activity: An activity that precedes another activity in the network.

3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.

2. PDF electronic file.

3. [2] paper copies.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.

2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.

3. Total Float Report: List of all activities sorted in ascending order of total float.

4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at monthly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.

2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.

4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.

5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.

2. Work under More Than One Contract: Include a separate activity for each contract.

3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

4. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.

b. Limitations of continued occupancies.

c. Uninterruptible services.

d. Partial occupancy before Substantial Completion.

e. Use of premises restrictions.

f. Provisions for future construction.

g. Seasonal variations.

h. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.

2. Unanswered Requests for Information.

3. Rejected or unreturned submittals.

4. Notations on returned submittals.

5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is [**14**] <**Insert number**> or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 30 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.

    b. Mobilization and demobilization.

    c. Purchase of materials.

    d. Delivery.

    e. Fabrication.

    f. Utility interruptions.

    g. Installation.

    h. Work by Owner that may affect or be affected by Contractor's activities.

    i. Testing and commissioning.

    j. Punch list and final completion.

    k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.

2. Description of activity.

3. Main events of activity.

4. Immediate preceding and succeeding activities.

5. Early and late start dates.

6. Early and late finish dates.

7. Activity duration in workdays.

8. Total float or slack time.

9. Average size of workforce.

10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.

2. Changes in early and late start dates.

3. Changes in early and late finish dates.

4. Changes in activity durations in workdays.

5. Changes in the critical path.

6. Changes in total float or slack time.

7. Changes in the Contract Time.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.

2. List of separate contractors at Project site.

3. Approximate count of personnel at Project site.

4. Equipment at Project site.

5. Material deliveries.

6. High and low temperatures and general weather conditions, including presence of rain or snow.

7. Accidents.

8. Meetings and significant decisions.

9. Unusual events.

10. Stoppages, delays, shortages, and losses.

11. Meter readings and similar recordings.

12. Emergency procedures.

13. Orders and requests of authorities having jurisdiction.

14. Change Orders received and implemented.

15. Construction Work Change Directives received and implemented.

16. Services connected and disconnected.

17. Equipment or system tests and startups.

18. Partial completions and occupancies.

19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 – PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.

2. Periodic construction photographs.

B. Related Sections include the following:

1. Division 1 Section "Closeout Procedures" for submitting digital media as Project Record Documents at Project closeout.

1.03 SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same label information as corresponding set of photographs.

B. Construction Photographs: Submit two prints of each photographic view within seven days of taking photographs.

1. Format: 4-by-6-inch smooth-surface matte prints on single-weight commercial-grade photographic paper, enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.

2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:

a. Date photograph was taken if not date stamped by camera.

b. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

c. Unique sequential identifier.

3. Digital Images: Submit a complete set of digital image electronic files with each submittal of prints as a Project Record Document on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

1.04 COORDINATION

A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

1.05 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1024 by 768 pixels.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in filename for each image.

2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.

C. Preconstruction Photographs: Before commencement of demolition, take color, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Take eight photographs to show existing conditions adjacent to property before starting the Work.

2. Take twenty photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take 12 color, digital photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of color, digital photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

F. Final Completion Construction Photographs: Take eight color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.

1. Do not include date stamp.

END OF SECTION 013233

SECTION 013300 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
b. Contractor shall execute a data licensing agreement in the form of Architects CAD Release form.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow [**7**] seven days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow [**7**] seven days for review of each resubmittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of subcontractor.
    g. Name of supplier.
    h. Name of manufacturer.
    i. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

    j. Number and title of appropriate Specification Section.
    k. Drawing number and detail references, as appropriate.
    l. Location(s) where product is to be installed, as appropriate.
    m. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.

a. Transmittal Form for Paper Submittals: Use AIA Document G810.
b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

1) Project name.
2) Date.
3) Destination (To:).
4) Source (From:).
5) Name and address of Architect.
6) Name of Construction Manager.
7) Name of Contractor.
8) Name of firm or entity that prepared submittal.
9) Names of subcontractor, manufacturer, and supplier.
10) Category and type of submittal.
11) Submittal purpose and description.
12) Specification Section number and title.
13) Specification paragraph number or drawing designation and generic name for each of multiple items.
14) Drawing number and detail references, as appropriate.
15) Indication of full or partial submittal.
16) Transmittal number.
17) Submittal and transmittal distribution record.
18) Remarks.
19) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:

a. Project name.
b. Date.
c. Name and address of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Name of firm or entity that prepared submittal.

g. Names of subcontractor, manufacturer, and supplier.
h. Category and type of submittal.
i. Submittal purpose and description.
j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.
m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

a. Project name.
b. Number and title of appropriate Specification Section.
c. Manufacturer name.
d. Product name.

F. Options: Identify options requiring selection by Architect.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Submit electronic submittals via email as PDF electronic files.

a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit [3] three paper copies of each submittal unless otherwise indicated. Architect will return [2] two copies.
3. Informational Submittals: Submit [2] two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

    a. PDF electronic file.
    b. [4] Four paper copies of Product Data unless otherwise indicated. Architect will return [2] two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.

e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 by 36 inches.
3. Submit Shop Drawings in the following format:

a. PDF electronic file.
b. [4] Four opaque (bond) copies of each submittal. Architect will return [2] two copies.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of applicable Specification Section.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit [2] two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit [3] three sets of Samples. Architect will retain [2] two Sample sets; remainder will be returned.

1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least [3] three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Submit product schedule in the following format:

a. PDF electronic file.
b. [3] Three paper copies of product schedule or list unless otherwise indicated. Architect will return [2] two copies.

F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

I. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and [3] three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action as follows:

1. “NO EXCEPTIONS TAKEN”: Submission is in full compliance with all contract documents, or indicated deviations are acceptable.

2. “MAKE CORRECTIONS NOTED”: Submission has minor corrections not significant enough to require resubmission; noted corrections must be made in final installation.

3. “REJECTED”: Submission does not meet contract requirements; resubmission of shop drawings, which meet contract requirements, is required.

4. “AMEND AND RESUBMIT”: Resubmission is required due to the nature and/or number and corrections.

C. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 016000 – PRODUCT REQUIREMENTS

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. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:

1. Division 01 Section “Substitution Procedures”.
2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

a. Specification Section number and title.
b. Generic name used in the Contract Documents.
c. Proprietary name, model number, and similar designations.
d. Manufacturer's name and address.
e. Supplier's name and address.
f. Installer's name and address.
g. Projected delivery date or time span of delivery period.
h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within thirty (30) days after date of commencement of the Work, submit three (3) copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within sixty (60) days after date of commencement of the Work, submit three (3) copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within fifteen (15) days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified material or product cannot be provided.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.

f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within ten (10) days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance: Change Order.
b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.

2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system.

8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within thirty (30) days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017310 – CUTTING AND PATCHING

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. All Divisions for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.03 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.04 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.

2. Membranes and flashings.

3. Equipment supports.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the

exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.03 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Concrete/Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

3. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

4. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

   b. Restore damaged pipe covering to its original condition.

3. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017310

SECTION 017700 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.

2. Warranties.

3. Final cleaning.

B. Related Sections include the following:

1. Division 1 Section "Photographic Documentation" for submitting Final Completion construction photographs and negatives.

1.03 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.

2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

3. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

4. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

5. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

6. Complete final cleaning requirements, including touchup painting.

7. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. Results of completed inspection will form the basis of requirements for Final Completion.

1.04 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment.

2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

2. Include the following information at the top of each page:

a. Project name.

b. Date.

c. Name of Architect.

d. Name of Contractor.

e. Page number.

1.06 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Final Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

d. Remove tools, construction equipment, machinery, and surplus material from Project site.

e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

g. Remove labels that are not permanent.

h. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 017823 – OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    b. Enable inserted reviewer comments on draft submittals.
2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.

2. Table of contents.

3. Manual contents.

C. Title Page: Include the following information:

1. Subject matter included in manual.

2. Name and address of Project.

3. Name and address of Owner.

4. Date of submittal.

5. Name and contact information for Contractor.

6. Name and contact information for Construction Manager.

7. Name and contact information for Architect.

8. Name and contact information for Commissioning Authority.

9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.

10. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.

4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.

2. Emergency instructions.

3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.

2. Flood.

3. Gas leak.

4. Water leak.

5. Power failure.

6. Water outage.

7. System, subsystem, or equipment failure.

8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.

2. Shutdown instructions for each type of emergency.

3. Operating instructions for conditions outside normal operating limits.

4. Required sequences for electric or electronic systems.

5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.

2. Performance and design criteria if Contractor is delegated design responsibility.

3. Operating standards.

4. Operating procedures.

5. Operating logs.

6. Wiring diagrams.

7. Control diagrams.

8. Piped system diagrams.

9. Precautions against improper use.

10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.

2. Manufacturer's name.

3. Equipment identification with serial number of each component.

4. Equipment function.

5. Operating characteristics.

6. Limiting conditions.

7. Performance curves.

8. Engineering data and tests.

9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.

2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.

4. Regulation and control procedures.

5. Instructions on stopping.

6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.

9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.

2. Manufacturer's name.

3. Color, pattern, and texture.

4. Material and chemical composition.

5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.

2. Types of cleaning agents to be used and methods of cleaning.

3. List of cleaning agents and methods of cleaning detrimental to product.

4. Schedule for routine cleaning and maintenance.

5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance

procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.

2. Troubleshooting guide.

3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.

6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit [3] three set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit [1] one paper-copy set(s) of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and [1] one set of file prints.
3) Submit record digital data files and [1] one set(s) of plots.
4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit [3] three paper-copy set(s) of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and [3] three set(s) of prints.
3) Print each drawing, whether or not changes and additional information were recorded.

c. Final Submittal:

1) Submit [1] one paper-copy set(s) of marked-up record prints.
2) Submit record digital data files and [3] three set(s) of record digital data file plots.
3) Plot each drawing file, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy [1], annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy [1], annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Record data as soon as possible after obtaining it.
    c. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
4. Refer instances of uncertainty to Architect for resolution.
5. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.

3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 024113 – SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of a building or structure.
   2. Repair procedures for selective demolition operations.

B. Related Sections include the following:

   1. Division 1 Section "Summary of Work" for use of the premises and phasing requirements.
   2. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.

1.03 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

B. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

   1. Coordinate with Owner's representative, who will establish special procedures for removal and salvage.

1.05 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

C. 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 representative that on-site operations are uninterrupted.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of temporary partitions and means of egress**,** affected by selective demolition operations.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

E. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.06 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Coordination."

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

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.

1.07 PROJECT 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. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for condition of areas to be selectively demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site will not be 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.

G. Selective demolition area shall remain in a broom clean condition on a daily basis with all demolished materials being removed daily.

1.08 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

1. If possible, retain original Installer or fabricator to patch the exposed Work listed below that is damaged during selective demolition. If it is impossible to engage original Installer or fabricator, engage another recognized experienced and specialized firm.

a. Processed concrete finishes.
b. Stonework and stone masonry.
c. Ornamental metal.
d. Matched-veneer woodwork.
e. Preformed metal panels.
f. Roofing.
g. Firestopping.
h. Window wall system.
i. Stucco and ornamental plaster.
j. Terrazzo.
k. Finished wood flooring.
l. Fluid-applied flooring.
m. Aggregate wall coating.
n. Wall covering.
o. Swimming pool finishes.
p. HVAC enclosures, cabinets, or covers.

PART 2 - PRODUCTS

2.01 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

1. Provide at least 72 hours notice to Owner if shutdown of service is required during changeover.

C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

1. Building manager will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.03 PREPARATION

A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Pest Control: Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

C. 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.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
3. Protect existing site improvements, appurtenances, and landscaping to remain.
4. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

D. Temporary Facilities: 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.

E. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

F. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

G. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction 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.

3.04 POLLUTION CONTROLS

A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. Cleaning: 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.

3.05 SELECTIVE DEMOLITION

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, to minimize disturbance of adjacent surfaces. 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 fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.
10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

C. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items: Comply with the following:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
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.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, 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.

F. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

G. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

H. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

I. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

J. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

K. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.06 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching: Comply with Division 1 Section "Cutting and Patching."

C. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.

D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

E. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Burning: Burning of demolished materials will be permitted only at designated areas on Owner's property, providing required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 024113

SECTION 028310 – LEAD-SAFE WORK PRACTICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quality assurance requirements including personnel training.

2. Regulatory requirements.

3. Work practices.

4. Requirements for transport and disposal of lead waste materials by legal and appropriate means.

1.2 REFERENCES

A. United States Environmental Protection Agency (USEPA):

1. 40 CFR Part 260 - Hazardous waste Management system: General

2. 40 CFR Part 261 - Identification and Listing of Hazardous Waste.

3. 40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste.

4. 40 CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste.

5. 40 CFR Part 264 - Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities.

6. 40 CFR Part 265 - Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities.

7. 40 CFR Part 266 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities.

8. 40 CFR Part 268 - Land Disposal Restrictions.

9. 40 CFR Part 270 – EPA Administered Permit Programs: The Hazardous Waste Permit Program.

10. 40 CFR Part 745, Subpart L - Lead-Based Paint Activities.

11. 40 CFR Part 745, Subpart E - Residential Property Renovation.

B. United States Department of Transportation (DOT):

1. 49 CFR 171 -General Information, Regulations, and Definitions.

2. 49 CFR 172 - Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements.

3. 49 CFR 173 - Shippers -General Requirements for Shipments and Packaging.

C. Occupational Safety and Health Administration (OSHA):

1. 29 CFR 1 926.62 - Construction Standard for Lead

1.3 SCOPE OF WORK

A. The scope of work for lead abatement safe work practices includes the management of lead and or lead based painted surfaces and/or components known or presumed to contain lead in concentrations equal to or in excess of 1.0 milligrams/per square centimeter or 0.5% by weight during renovation activities in target housing and child occupied facilities as detailed within United States Environmental Protection Agency standard for Residential Property Renovation, cited as 40 CFR Part 745, Subpart E; and

B. In all instances including those where building components are known or suspected to contain lead in concentrations below 0.5% by weight, and construction, alteration and/or repair work is performed in areas of the building/exterior which are not considered target housing and/or child occupied facilities lead safe work practices shall include all provisions as set forth under Occupational Safety and Health Administration (OSHA) regulation for Occupational Exposure to Lead, cited as 29 CFR 1926.62.

1.4 DEFINITIONS

A. Child-Occupied Facility: A building, or portion of a building, constructed prior to 1978, visited regularly by the same child, under 6 years of age, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3 hours and the combined weekly visits last at least 6 hours, and the combined annual visits last at least 60 hours. Child-occupied facilities may include, but are not limited to, day care centers, preschools and kindergarten classrooms. Child-occupied facilities may be located in target housing or in public or commercial buildings. With respect to common areas in public or commercial buildings that contain child-occupied facilities, the child-occupied facility encompasses only those common areas that are routinely used by children under age 6, such as restrooms and cafeterias. Common areas that children under age 6 only pass through, such as hallways, stairways, and garages are not included. In addition, with respect to exteriors of public or commercial buildings that contain child-occupied facilities, the child-occupied facility encompasses only the exterior sides of the building that are immediately adjacent to the child-occupied facility or the common areas routinely used by children under age 6.

B. Cleaning Verification Card: Card developed and distributed, or otherwise approved, by EPA for the purpose of determining, through comparison of wet and dry disposable cleaning cloths with the card whether post-renovation cleaning has been properly completed.

C. Lead: Metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded in this definition are all other organic lead compounds.

D. Lead-Based Paint (LBP): Paint or other surface coatings that contain lead equal to or in excess of 1.0 mg/cm^2 or 0.5% by weight or air.

E. Minor repair and maintenance activities are activities, including minor heating, ventilation conditioning work, electrical work, and plumbing, that disrupt 6 square feet or less of painted surface per room for interior activities or 20 square feet or less of painted surface for exterior where none of the work practices prohibited or restricted by §745.S5(a)(3) are used and when the work does not involve window replacement or demolition of painted surface areas. When

removing painted components, or portions of painted components, the entire surface area removed is the amount of painted surface disturbed. Jobs, other than emergency renovations, performed in the same room within the same 30 days must be considered the same job for the purpose of determining whether the job is a minor repair and maintenance activity.

F. Pamphlet: The EPA pamphlet entitled Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools developed under section 406(a) of TSCA for use in complying with Section 406(b) of TSCA, or any State or Tribal pamphlet approved by EPA pursuant to 40 CFR 745.326 that is developed for the same purpose.

G. Renovation: The modification of any existing structure, or portion thereof, that results in the disturbance of painted surfaces, unless that activity is performed as part of an abatement as defined by this part (40 CFR 745.223). The term renovation includes, but is not limited to, the removal, modification or repair of painted surfaces or painted components (e.g., modification of painted doors, surface restoration, window repair, surface preparation activity such as sanding, scraping, or other such activities that may generate paint dust); the removal of building components (e.g., walls, ceilings, plumbing, windows); weatherization projects (e.g., cutting holes in painted surfaces to install blown-in insulation or to gain access to attics, planing thresholds to install weather-stripping), and interim controls that disturb painted surfaces. A renovation performed for the purpose of converting a building, or part of a building, into target housing or a child-occupied facility, is a renovation under this subpart. The term renovation does not include minor repair and maintenance activities.

H. Renovator: An individual who either performs or directs workers who perform renovations. A certified renovator is a renovator who has successfully completed a renovator course accredited by EPA or an EPA-authorized State or Tribal program.

I. Work Area: The area that the certified renovator establishes to contain the dust and debris generated by a renovation.

1.5 SYSTEM DESCRIPTION

A. Lead-Safe Work Practices: Lead-Safe Work Practices provide for disturbance of lead, including removal and disposal of lead-based paint; lead containing dust; and lead contaminated soil in accordance with all applicable codes, regulations, standards, laws and ordinances and provides anticipated general overview of requirements and conditions necessary to meet regulatory requirements and specific conditions of this Project. Failure to expressly refer to applicable code, regulation, standard, law and ordinance within Contract Documents does not imply that applicable regulatory requirements are not applicable to this Project.

1. Presumed Lead Containing Surfaces: Surfaces for which there is no analytical data, and are suspected to contain lead based on age, use or other factors, should be presumed to contain lead at a level above 0.5% until a negative determination can be made through recognized industry standards.

1.6 SUBMITTALS

A. Quality Control Submittals:

1. Submit the following items prior to beginning lead related activities at the site:

a. Valid Waste Transporter Permit, issued by State of New Jersey.

b. Written communication from designated treatment, storage or disposal facility that it:

1) Is authorized to receive and dispose of waste products generated by this Project;

2) Has the capacity to receive and dispose of waste products generated by this Project and;

3) Will provide or assure that ultimate disposal method indicated on manifest for particular hazardous waste(s) will be followed.

c. Instructions regarding requirements for distribution of waste manifest as completed at time of shipment.

d. Emergency Contact List.

e. A written acknowledgment that the owner has received the EPA pamphlet entitled Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools.

f. Provide a certificate of mailing at least seven (7) days prior to the renovation.

g. A statement describing the steps performed to notify all occupants, parents and guardians of the intended renovation activities and to provide the pamphlet

2. Submit the following items during course of lead related activities at site:

a. Employee Training and Certification Documentation: Provide Owner with Valid Training and Certification documentation for all renovators in accordance with 40 CFR Part 745.90(a) prior to beginning work.

3. Submit the following items after completion of lead related activities at Site:

a. Daily Logs.

b. Sign in Sheets.

c. Documentation of Hazardous Waste Determination, consisting of Toxicity Characteristic Leachate Procedure sample analysis and documentation that identifies the material(s) sampled.

d. For waste that is known or determined to be hazardous, New York State Uniform Hazardous Waste Manifest or manifest as required by the state where the waste is disposed.

e. Trip Tickets for all other waste.

4. Certificates: Submit certification that indicates compliance with requirements specified in Quality Control below.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Contractor:

    a. Supervision: Provide full-time, on-site supervisor for each site.

    b. Personnel Certification Requirements:

        1) Lead Personnel: Received "Lead-Safe Work Practices" training approved by United States Department of Housing and Urban Development (HUD) within the last 12 months.

        2) Lead Supervisory Personnel: Maintain current USEPA certification as a lead-based paint abatement supervisor as per 40 CFR 763.

    c. Personnel Training Requirements: In addition to the training requirements for USEPA certification, all supervisory or Lead-Safe Work Practice personnel, including any personnel entering lead activity areas shall have training as required by 29 CFR 1926.62

2. Owner's Sampling / Monitoring Firm: Independent of Contractor and possessing current USEFTA certification to perform lead-based paint activities. May not be applicable to the project.

    a. Personnel Certification:

        1) Monitoring: Possess current USEPA certification, as per 40 CFR 745, subpart L, as either "Risk Assessor" or "Inspector".

        2) Final Inspection or Clearance Testing Possess current USEPA certifications, as per 40 CFR 745, subpart L, as either "Risk Assessor" or "Inspector".

3. Lead Analysis Laboratories:

    a. Maintain current National Lead Laboratory Accreditation Program (NLLAP) accreditation.

    b. Maintain current New Jersey Environmental Laboratory Approval Program (ELAP) accreditation in each method of analysis used.

    c. Use most recent version of specified test method.

    d. Analyze samples for waste characterization using:

        1) Toxicity Characteristic Leachate Procedure - EPA Method 1311 and an acceptable, EPA recognized analysis method.

    e. Analyze air samples for lead for total lead (if required) using an acceptable, EPA recognized analysis method.

    f. Analyze wipe samples, paint chip samples and soil samples using an acceptable, EPA recognized analysis method.

B. Regulatory Requirements:

1. Hazardous Waste Generator Status: Owner is "Conditionally Exempt Small Quantity Generator as defined by 6 NYCRR 371 and 40CFR 260. Schedule removal, on-site storage, and transport as required to maintain Owner's status as "Conditionally Exempt Small Quantity Generator.

C. Recordkeeping and Reporting Requirements: Firms performing renovations must retain and, if requested, make available to EPR at records necessary to demonstrate compliance with this subpart for a period of 3 years following completion of the renovation. This 3-year retention requirement does not supersede longer obligations required by other provisions for retaining the same documentation, including any applicable State or Tribal laws or regulations.

1. Records that must be retained pursuant to paragraph (a) of this section shall include (where applicable):

a. Reports certifying that a determination had been made by an inspector (certified pursuant to either Federal regulations at §745.226 or an EPA-authorized State or Tribal certification program) that lead-based paint is not present on the components affected by the renovation, as described in §745.82(b)(1).

b. Signed and dated acknowledgments of receipt as described in §745.84(a)(1)(i), (a)(2)(i), (b)(1)(i), (c)(1)(i)(A), and (c)(1)(ii)(A).

c. Certifications of attempted delivery as described in §745.84(a)(2)(i) and (c)(1)(ii)(A).

d. Certificates of mailing as described in §745.84(a)(1)(ii), (a)(2)(ii), (b)(1)(ii), (c)(1)(i)(B) and (c)(1)(ii)(B).

e. Records of notification activities performed regarding common area renovations, as described in §745.B4(b)(3) and (b)(4), and renovations in child-occupied facilities, as described in §745.84(c)(2).

f. Any signed' and dated statements received from owner-occupants documenting that the requirements of §745.85 do not apply. These statements must include a declaration that the renovation will occur in the Owner’s residence, a declaration that no children under age 6 reside there, a declaration that no pregnant woman resides there, a declaration that the housing is not a child-occupied facility, the address of the unit undergoing renovation, the owner's name, an acknowledgment by the owner that the work practices to be used during the renovation will not necessarily include all of the lead-safe work practices contained in EPA's renovation, repair, and painting rule, the signature of the owner, and the date of signature. These statements must be written in the same language as the text of the renovation contract, if any.

g. Documentation of compliance with the requirements of §745.85, including documentation that a certified renovator was assigned to the project, that the certified renovator provided on-the job training for workers used on the project, that the certified renovator performed or directed workers who performed all of the tasks described in §745.85(a), and that the certified renovator performed the post-renovation cleaning verification described in §745.85(b). If the renovation firm was unable to comply with all of the requirements of this rule due to an emergency as defined in §745.82, the firm must document the nature of the emergency and the provisions of the rule that were not followed. This documentation must include a

copy of the certified renovator's training certificate, and a certification by the certified renovator assigned to the Project that:

h. Training was provided to workers (topics must be identified for each worker).

i. Warning signs were posted at the entrances to the work area.

j. If test kits were used, that the specified brand of kits was used at the specified locations and that the results were as specified.

k. The work area was contained by:

1) Removing or covering all objects in the work area (interiors).

2) Closing and covering all HVAC ducts in the work area (interiors).

3) Closing all windows in the work area (interiors) or closing all windows in and within 20 feet of the work area (exteriors).

4) Closing and sealing all doors in the work area (interiors) or closing and sealing all doors in and within 20 feet of the work area (exteriors).

5) Covering doors in the work area that were being used to allow passage but prevent spread of dust.

6) Covering the floor surface, including installed carpet, with taped-down plastic sheeting or other impermeable material in the work area 6 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to contain the dust, whichever is greater (interiors) or covering the ground with plastic sheeting or other disposable impermeable material anchored to the building extending 10 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to collect falling paint debris, whichever is greater, unless the property line prevents 10 feet of such ground covering, weighted down by heavy objects (exteriors).

7) Installing (if necessary) vertical containment to prevent migration of dust and debris to adjacent property (exteriors).

l. Waste was contained on-site and while being transported off-site

m. The work area was properly cleaned after the renovation by:

1) Picking up all chips and debris, misting protective sheeting, folding it dirty side inward, and taping it for removal.

2) Cleaning the work area surfaces and objects using a HEPA vacuum and/or wet cloths or mops (interiors).

n. The certified renovator performed the post-renovation cleaning verification (the results of which must be briefly described, including the number of wet and dry cloths used).

o. When test kits are used, the renovation firm must, within 30 days of the completion of the renovation, provide identifying information as to the manufacturer and model

of the test kits used, a description of the components that were tested including their locations, and the test kit results to the person who contracted for the renovation.

p. If dust clearance sampling is performed in lieu of cleaning verification as permitted by §745.85(c), the renovation firm must provide, within 30 days of the completion of the renovation, a copy of the dust sampling report to the person who contracted for the renovation.

1.8 PROJECT/SITECONDITIONS

A. Emergency Contact List: Prepare emergency contact list providing means to contact applicable individuals and agencies in event of emergency at any time of day or night and including at least the following individuals and agencies:

1. Contractor Personnel:

a. Project manager
b. Project supervisor

2. Sampling Organization:

a. On Site Sampling Technician

3. Owner

4. Local police department

5. Local fire department

6. Local hospital and ambulance service

B. Restrict access to all work areas. Immediately report any access by unauthorized individuals to Owner and/or Owner's representative.

1.9 SEQUENCING AND SCHEDULING

A. Completion: Complete Lead related work in accordance with Construction Schedule requirements with each phase considered distinct and separate for purpose of schedule and substantial completion.

1. Substantial Completion of phase occurs when:

a. All components of phase have passed visual inspection by Supervisor; and
b. Satisfactory clearance criteria are achieved for each portion of phase; and
c. All containment barriers have been removed; and
d. Areas are returned to Owner.

2. If Contractor fails to achieve substantial completion within specified schedule requirements, all costs associated with extension of schedule, including (but not limited to) cost of Architect's time and expenses, sampling costs, monitoring costs, direct costs incurred by Owner, and costs to accelerate sample analysis deducted from Final Payment.

B. Restrictions on Working Hours: Schedule work only during regular working hours approved by Owner prior to beginning lead related work. Do not use overtime or multiple shifts with "overtime" defined as any time in excess of 8 hours in single day, work on weekends, or work on holidays.

C. Changes in Working Hours: Advise Owner of any changes in hours or days when lead activities will be conducted at Site at least 24 hours prior to change. Contractor retains all liability resulting from Contractor failure to make required notification.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Respirators: Provide respirators approved as acceptable for protection by National Institute for Occupational Safety and Health (NIOSH) under provisions of 30 CFR Part 11.

1. Supply and use respirators as required in accordance with 29 CFR 1910.134 and 29 CFR 1926.62.

2. Provide respirators, filters and ancillary supplies as required for employees and authorized visitors.

3. Account for hazards other than lead in respirator selection.

B. Protective Clothing: Provide disposable protective clothing complying with requirements of 29 CFR 1926.62 that is disposed of after one use. Provide disposable clothing as required for employees and authorized visitors.

C. Lead Related Construction Facilities and Controls:

1. Polyethylene sheeting (plastic sheeting) - 6-mil thickness, sized to minimize seams.

2. Tape and/or adhesive spray capable of sealing joints in adjacent polyethylene sheets and for attachment of polyethylene sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions, including use of amended water;

3. Polyethylene waste disposal bags -6-milthickness with preprinted labels;

4. HEPA filtered negative pressure equipment.

5. HEPA filtered vacuums.

6. Water filtration, 3 stage with final filtration to at least 5 microns.

7. Barrier tape.

8. Warning signs.

9. Hygiene facilities as required by 29 CFR 1926.62 including showers, cleansing agents and disposable towers.

10. Lead specific detergent similar to:

a. “Ledizsolv Detergent” by LSV, Inc., New York, New York.

b. “Sentines 805 EnviroWash” by Sentinel, Minneapolis, Minnesota.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions (by Contractor): Examine conditions under which lead related work is to be performed and notify Owner in writing of any conditions detrimental to proper and timely performance. Do not proceed with lead related work until unsatisfactory have been corrected in manner acceptable to Contractor.

3.2 PREPARATION

A. Notification:

1. While the renovation is ongoing, post informational signs describing the general nature and locations of the renovation and the anticipated completion date. These signs must be posted in areas where they can be seen by the parents or guardians of the children frequenting the child-occupied facility. The signs must be accompanied by a posted copy of the pamphlet or information on how interested parents or guardians can review a copy of the pamphlet or obtain a copy from the renovation firm at no cost to the parents or guardians.

2. Post signs clearly defining the work areas and warning occupants and other persons not involved in renovation activities to remain outside of the work areas. These signs must be posted before beginning the renovation and must remain in place and readable until the renovation and the post-renovation cleaning verification have been completed.

B. Protection:

1. Provide personal protective equipment as required by 29 CFR 1926.62 at no cost to employees or authorized visitors.

2. Institute respirator program in accordance with 29 CFR 1926.62 and 29 CFR 1910.134 (b), (d), (e) and (f).

3. Use protective clothing and respirators whenever lead is being disturbed, abated, cleaned up, and containerized or stored in vehicle or container used to transport waste to landfill in accordance with applicable regulations.

4. Institute medical surveillance program in accordance with 29 CFR 1926.62 for all employees performing or supervising lead handling work, entering work area containment, or using respirator.

C. Prior to all other preparation activities, construct wash station or decontamination facilities as required by applicable regulations adjacent to lead work area.

D. Before beginning the renovation, the firm must isolate the work area so that no dust or debris leaves the work area while the renovation is being performed. In addition, the firm must maintain the integrity of the containment by ensuring that any plastic or other impermeable materials are not torn or displaced, and taking any other steps necessary to ensure that no dust or debris leaves the work area while the renovation is being performed. The firm must also

ensure that containment is installed in such a manner that it does not interfere with occupant and worker egress in an emergency.

E. Exterior Renovations: For all exterior renovations, the firm conducting the work shall:

1. Close all doors and windows within 20 feet of the renovation. On multi-story buildings, close all doors and windows within 20 feet of the renovation on the same floor as the renovation, and close all doors and windows on all floors below that are the same 'horizontal distance from the renovation.

2. Ensure that doors within the work area that will be used while the job is being performed are covered with plastic sheeting or other impermeable material in a manner that allows workers to pass through while confining dust and debris to the work area.

3. Cover the ground with plastic sheeting or other disposable impermeable material extending 10 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to collect falling paint debris, whichever is greater, unless the property line prevents 10 feet of such ground covering.

4. In certain situations, the renovation firm must take extra precautions in containing the work area to ensure that dust and debris from the renovation does not contaminate other buildings or other areas of the property or migrate to adjacent properties.

F. Interior renovations. For all interior renovations, the firm conducting the work shall:

1. Remove all objects from the work area, including furniture, rugs, and window coverings, or cover them with plastic sheeting or other impermeable material with all seams and edges taped or otherwise sealed.

2. Close and cover all ducts opening in the work area with taped-down plastic sheeting or other impermeable material.

3. Close windows and doors in the work area. Doors must be covered with plastic sheeting or other impermeable material. Doors used as an entrance to the work area must be covered with plastic sheeting or other impermeable material in a manner that allows workers to pass through while confining dust and debris to the work area.

4. Cover the floor surface, including installed carpet, with taped-down plastic sheeting or other impermeable material in the work area 6 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to contain the dust, whichever is greater.

5. Use precautions to ensure that all personnel, tools, and other items, including the exteriors of containers of waste, are free of dust and debris before leaving the work area.

6. The firm must clean all objects and surfaces in the work area and within 2 feet of the work area in the following manner, cleaning from higher to lower:

7. Clean walls starting at the ceiling and working down to the floor by either vacuuming with a HEPA vacuum or wiping with a damp cloth.

8. Thoroughly vacuum all remaining surfaces and objects in the work area, including furniture and fixtures, with a HEPA vacuum. The HEPA vacuum must be equipped with a beater bar when vacuuming carpets and rugs.

9. Wipe all remaining surfaces and objects in the work area, except for carpeted or upholstered surfaces, with a damp cloth. Mop uncarpeted floors thoroughly, using a mopping method that keeps the wash water separate from the rinse water, such as the 2-bucket mopping method, or using a wet mopping system.

G. Do not begin lead disturbance or removal activities until all preparation work, including installation of wash stations or decontamination enclosure systems and any required engineering controls (ex. negative air pressure equipment, etc.) has been completed as required by applicable regulations.

3.3 LEAD WORK PROCEDURES

A. Exterior Lead Work Constraints: Do not proceed with lead activities if wind speeds are greater than 20 miles per hour. Stop lead activities and proceed with cleanup activities before rain begins.

B. Unacceptable Removal Methods:

1. Open flame burning or torching (includes propane-fueled heat grids).

2. Machine sanding, grinding, power planning, needle gun without HEPA local vacuum exhaust tool.

3. Hydroblasting or high-pressure wash.

4. Abrasive blasting or sandblasting without HEPA vacuum exhaust tool.

5. Heat guns operating above 1,100 deg. F.

6. Methylene chloride paint removal products.

7. Dry scraping.

C. Acceptable Removal Methods:

1. Component Removal:

a. Mist all disturbed paint and dust and maintain in moist condition.

b. Entirely remove indicated components.

c. Wet scrape residual paint from adjacent unpainted surfaces. Do not damage adjacent surfaces;

d. Collect all paint chips, dust and debris and seal in 6 mil plastic bags.

e. Seal removed building components in 6 mil plastic sheeting or 6 mil plastic bags.

2. Heat Gun Removal (operating at less than 1,100 deg. F):

a. Provide fire extinguishers in lead work area, and ensure adequate electrical power is available.

b. Use in limited areas only.

c. Do not gouge or abrade substrate.

3. Wet Scraping:

a. Apply adequate water to moisten surface completely; avoid large amounts of water on floor or ground.

b. Do not moisten areas near electrical circuits.

c. Use spray bottles or wet sponge attached to scraper.

4. Offsite Stripping:

a. Apply paint removers in accordance with manufacturer's recommendations.

b. Test paint remover in inconspicuous location approved by Architect to avoid damage to substrate.

c. Identify building component to ensure reinstallation in same location.

d. Mist all paint and dust disturbed and maintain in moist condition.

e. Wet scrape residual paint from adjacent unpainted surfaces. Do not damage adjacent surfaces.

f. Collect all paint chips, dust and debris and seal in 6 mil plastic bags. Seal removed building components in plastic sheeting. Inform offsite paint remover regarding presence of lead-based paint before shipping;

g. Do not reinstall components until removal of residual paint and cleaning is complete and satisfactory clearance verification achieved.

5. Onsite Stripping:

a. Apply paint removers in accordance with manufacture’s recommendations.

b. Test paint remover in inconspicuous location approved by Architect to avoid damage to substrate.

c. Do not damage adjacent surfaces.

d. Collect all paint chips, dust and debris and seal in 6 mil plastic bags.

6. Work Stoppage Criteria During Lead Activities:

a. During lead related activities, stop work immediately if damaged containment barriers are discovered or if dust or paint chips are discovered outside of lead work area.

b. Prior to resumption of lead activities, perform cleanup of areas adjacent to lead work area using HEPA vacuums or wet cleaning methods.

D. Clean Up Procedures:

1. Exterior:

    a. At end of each day, whether or not lead related activities are complete, clean up and store all removed components, debris, and plastic sheeting drop cloths in lockable containers with solid floors, walls and ceilings until transported off site.

    b. HEPA vacuum and wash all plastic sheeting with lead specific detergent.

    c. Place all plastic sheeting used to cover ground and seal openings to interior of building in containers.

    d. A certified renovator must perform a visual inspection to determine whether dust, debris or residue is still present on surfaces in and below the work area, including windowsills and the ground. If dust, debris or residue is present, these conditions must be eliminated and another visual inspection must be performed. When the area passes the visual inspection, remove the warning signs.

2. Interior:

    a. Conduct ongoing cleaning during lead related activities, including regular removal of large and small debris.

    b. Clean up visible debris and components prior to leaving lead work site at end of work shift.

    c. Decontaminate all tools, equipment, and worker protection gear before removing from contaminated areas.

    d. Wait at least t hour after active lead removal or disturbance has ceased before final cleaning.

E. After a successful visual inspection, a certified renovator must:

1. Verify that each windowsill in the work area has been adequately cleaned, using the following procedure.

2. Wipe the windowsill with a wet disposable cleaning cloth that is damp to the touch. If the cloth matches or is lighter than the cleaning verification card, the windowsill has been adequately cleaned.

3. If the cloth does not match and is darker than the cleaning verification card, re-clean the windowsill, then either use a new cloth or fold the used cloth in such a way that an unused surface is exposed, and wipe the surface again. If the cloth matches or is lighter than the cleaning verification card, that windowsill has been adequately cleaned.

4. If the cloth does not match and is darker than the cleaning verification card, wait for t hour or entire surface has dried completely, whichever is longer.

5. After waiting for the windowsill to dry, wipe the windowsill with a dry disposable cleaning cloth. After this wipe, the windowsill has been adequately cleaned.

6. Wipe uncarpeted floors and countertops within the work area with a wet disposable cleaning cloth. Floors must be wiped using an application device with a long handle and a head to which the cloth is attached. The cloth must remain damp at all times while it is

being used to wipe the surface for post-renovation cleaning verification. If the surface within the work area is greater than 40 square feet, the surface within the work area must be divided into roughly equal sections that are each less than 40 square feet. Wipe each such section separately with a new wet disposable cleaning cloth. If the cloth used to wipe each section of the surface within the work area matches the cleaning verification card, the surface has been adequately cleaned.

7. If the cloth used to wipe a particular surface section does not match the cleaning verification card, re-clean that section of the surface as directed in paragraphs (a)(5)(ii)(B) and (a)(5)(ii)(C) of this section, then use a new wet disposable cleaning cloth to wipe that section again. If the cloth matches the cleaning verification card, that section of the surface has been adequately cleaned.

8. If the cloth used to wipe a particular surface section does not match the cleaning verification card after the surface has been re-cleaned, wait for 1 hour or until the entire surface within the work area has dried completely, whichever is longer.

9. After waiting for the entire surface within the work area to dry, wipe each section of the surface that has not yet achieved post-renovation cleaning verification with a dry disposable cleaning cloth. After this wipe, that section of the surface has been adequately cleaned. When the work area passes the post-renovation cleaning verification, remove the warning signs.

F. Removal of Work Area Containment:

1. Do not remove remaining plastic sheeting, barriers, wash station, decontamination facilities, engineering controls and ancillary items until satisfactory clearance verification results are achieved.

2. Notify Owner immediately if any residual lead debris is identified during removal of plastic sheeting, barriers, decontamination facilities, negative pressure equipment and ancillary items, and clean up debris.

3. Clean all tape, glue, staples, etc., used in lead work process.

4. Repair damage to walls, floors, ceilings, fixtures, or other items not scheduled for demolition or lead work to pre-lead work condition. Where finishes are damaged, refinish or repaint entire object or to nearest break in surface of walls, ceilings, soffits, etc.

5. Remove entire containment when partial occupancy by Owner is required before Owner occupies area or other contractors occupy space for additional construction as required.

6. Paint or otherwise seal treated surfaces not scheduled for painting.

3.4 WASTE SEGREGATION AND CHARACTERIZATION

A. Segregate waste in following categories:

1. Removed components (considered construction and demolition debris for bidding purposes).

2. Paint chips, dust and filters from HEPA vacuums (considered hazardous waste for bidding purposes).

3. Respirator filter cartridges, rags, sponges, mops, scrapers and other materials used for testing lead work, and clean-up (considered construction and demolition debris for bidding purposes).

4. Contaminated soil (considered hazardous waste for bidding purposes).

5. Cleaned plastic sheeting and disposable work clothes (considered construction and demolition debris for bidding purposes).

B. Sample each container of waste to determine if it is characterized as hazardous waste, treating each sample as follows:

1. Prepare using Toxicity Characteristic Leachate Procedure, EPA method 1311.

2. Analyze for lead using EPA method 6010, 6020, 7420 or 7421.

3. Analyze for any other hazardous characteristic introduced into waste by lead procedures.

C. Consider cleaned plastic sheeting and disposable work clothes not sufficiently cleaned as hazardous waste and dispose as hazardous waste at no additional cost to Owner.

D. Maintain each waste category above in separate hard walled lockable containers until waste characterization is complete. If waste mixed from different categories, dispose all mixed waste as hazardous waste at no additional cost to Owner.

3.5 FIELD QUALITY CONTROL

A. Inspection of Barriers: Provide inspection of all barriers at least twice daily by Contractor's Supervisor and record inspections and observations in daily project log.

B. Repairs to Barriers and/or Enclosure Systems: Repair damage and defects in barriers and enclosure systems immediately upon discovery and prior to resumption of lead activities.

C. Testing By Owner: Owner reserves right to obtain independent monitoring and sampling services to provide independent documentation regarding compliance with regulatory requirements. Place all plastic sheeting used to cover ground and seal openings to interior of building in containers. A certified renovator must perform a visual inspection to determine whether dust, debris or residue is still present on surfaces in and below the work area, including windowsills and the ground. If dust, debris or residue is present, these conditions must be eliminated and another visual inspection must be performed. When the area passes the visual inspection, remove the warning signs.

D. Interior:

1. Conduct ongoing cleaning during lead related activities, including regular removal of large and small debris.

2. Clean up visible debris and components prior to leaving lead work site at end of work shift.

3. Decontaminate all tools, equipment, and worker protection gear before removing from contaminated areas.

4. Wait at least 1 hour after active lead removal or disturbance has ceased before final cleaning.

E. After a successful visual inspection, a certified renovator must:

1. Verify that each windowsill in the work area has been adequately cleaned, using the following procedure.

2. Wipe the windowsill with a wet disposable cleaning cloth that is damp to the touch. If the cloth matches or is lighter than the cleaning verification card, the window sill has been adequately cleaned.

3. If the cloth does not match and is darker than the cleaning verification card, re-clean the windowsill, then either use a new cloth or fold the used cloth in such a way that an unused surface is exposed, and wipe the surface again. If the cloth matches or is lighter than the cleaning verification card, that windowsill has been adequately cleaned.

4. If the cloth does not match and is darker than the cleaning verification card, wait for 1 hour or entire surface has dried completely, whichever is longer.

5. After waiting for the windowsill to dry, wipe the windowsill with a dry disposable cleaning cloth. After this wipe, the windowsill has been adequately cleaned.

6. Wipe uncarpeted floors and countertops within the work area with a wet disposable cleaning cloth. Floors must be wiped using an application device with a long handle and a head to which the cloth is attached. The cloth must remain damp at all times while it is being used to wipe the surface for post-renovation cleaning verification. If the surface within the work area is greater than 40 square feet, the surface within the work area must be divided into roughly equal sections that are each less than 40 square feet. Wipe each such section separately with a new wet disposable cleaning cloth. If the cloth used to wipe each section of the surface within the work area matches the cleaning verification card, the surface has been adequately cleaned.

7. If the cloth used to wipe a particular surface section does not match the cleaning verification card, re-clean that section of the surface as directed in paragraphs (a)(5)(ii)(B) and (a)(5)(ii)(C) of this section, then use a new wet disposable cleaning cloth to wipe that section again. If the cloth matches the cleaning verification card, that section of the surface has been adequately cleaned.

8. If the cloth used to wipe a particular surface section does not match the cleaning verification card after the surface has been re-cleaned, wait for 1 hour or until the entire surface within the work area has dried completely, whichever is longer.

9. After waiting for the entire surface within the work area to dry, wipe each section of the surface that has not yet achieved post-renovation cleaning verification with a dry disposable cleaning cloth. After this wipe, that section of the surface has been adequately cleaned. When the work area passes the post-renovation cleaning verification, remove the warning signs.

10. Where Owner provides monitoring, sampling (or both), use most stringent results from inspections, daily air sampling and clearance sampling.

F. Contractor Requirements:

1. Provide air sampling as required by 29 CFR 1926.62.

2. Provide sampling and analysis for waste characterization.

3. Provide access to lead work areas for Owner's Monitor / Sampling Technician as needed to observe all lead related work and collect samples.

4. Provide adequate lighting, ladders, scaffolding, and similar items to enable Monitor / Sampling Technician to perform visual inspections of all surfaces within lead work areas as needed.

5. Provide sufficient temporary electrical power to locations within lead work areas, as required, to supply high volume air sampling pumps for daily.

6. Do not perform any monitoring functions with Contractor's personnel or with firms wholly or partly owned by Contractor. Notify Owner and Architect immediately of any conflict of interest between Contractor and any firm providing monitoring, sampling or laboratory analysis.

7. Contractor retains complete and total responsibility for complying with Contract Documents and all regulatory requirements. Area Air Sampling Procedures (if used): Comply with provisions of NIOSH 7082.

G. Clearance Sampling Procedures (if used):

1. Owner reserves right to obtain independent monitoring and sampling services to provide independent documentation regarding compliance with regulatory requirements. Where Owner provides monitoring, sampling (or both), use most stringent results from inspections, daily air sampling and clearance sampling.

3.6 PACKAGING, TRANSPORTATION AND WASTE DISPOSAL PROCEDURES

A. Use hazardous waste characterization performed in accordance with “Waste Segregation and Characterization” above to document and confirm classification of waste. Prior to removing waste from site, confirm in writing to Owner:

1. Results of waste characterization testing.

2. Identification of waste documented to have waste classification identified in "Waste Segregation and Characterization" above.

3. Identification of waste characterization varying from "Waste Segregation and Characterization" above.

B. Packaging: Package, label, and mark all hazardous waste materials in accordance with applicable requirements of 49 CFR 173, 178 and 179.

C. Hazardous Waste Determination: Provide analysis required by Treatment, Storage or Disposal facility to document hazardous waste determination.

D. Hazardous Waste Manifests:

1. Maintain manifest from date of transport until date of disposal, destruction or recycling.

2. Return fully executed manifests to Owner within 60 days of date waste accepted by initial transporter.

3. Use following type of manifest as applicable:

   a. If waste disposed of in New York State or if waste disposed in state not requiring use of specific manifest form, use New York State Uniform Hazardous Waste Manifest.

   b. If waste disposed of in state other than New York State and use of specific manifest form is required, use manifest required by state where waste is disposed in lieu of New York State Uniform Hazardous Waste Manifest.

4. Complete manifest and deliver to Owner for review and signature.

5. Retain copies of manifest required to remain with hazardous waste shipment and deliver remaining copies to Owner.

6. Advise Owner regarding required distribution of manifest, both verbally and in writing.

E. Disposal: Transport hazardous waste to treatment or disposal facility complying with following requirements:

1. Permitted, licensed or registered by state to dispose of hazardous waste.

2. Possesses interim status to dispose of hazardous waste.

3. Authorized to manage hazardous waste under Resource Conservation and Recovery Act (RCRA).

4. Beneficially uses/re-uses or legitimately recycles/reclaims waste; or treats waste prior to beneficial use/reuse or legitimate recycling/reclamation.

F. Construction and Demolition Debris: Dispose of material determined to be Construction and Demolition Debris as such in accordance with 6 NYCRR 360 and 364. Provide trip tickets or other documentation clearly identifying amount of material removed from site, transported to disposal site and disposed of, including at least:

1. Name, address and telephone of waste generator.
2. Approximate quantity.
3. Name, and telephone of disposal site operator.

4. Name and physical site location of disposal site.
5. Name, address and telephone number of transporter.

END OF SECTION 028310

SECTION 076200 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Manufactured through-wall flashing.
2. Manufactured reglets.
3. Formed low-slope roof flashing and trim.
4. Formed wall flashing and trim.
5. Formed equipment support flashing.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

1. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft.: 90-lbf/sq. ft. perimeter uplift force, 120-lbf/sq. ft. corner uplift force, and 45-lbf/sq. ft. outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1. Copper Standard: Comply with CDA's "Copper in Architecture Handbook."

B. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave fascia, fascia trim, approximately 48 inches long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METALS

A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.

B. Lead-Coated Copper Sheet: ASTM B 101, Temper H00 and H01, cold-rolled copper sheet, of weight (thickness) indicated below, coated both sides with lead weighing not less than 12 lb/100 sq. ft. nor more than 15 lb/100 sq. ft. of copper sheet (total weight of lead applied equally to both sides).

C. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. Mill Finish: Standard one-side bright.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

1. Finish: No. 3 (reflective, polished directional satin).

E. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).

1. Product: Subject to compliance with requirements, provide "TCS II" by Follansbee Steel.

F. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality, mill phosphatized for field painting.

G. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 structural quality with manufacturer's standard clear acrylic coating both sides.

H. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
3. Exposed Finishes: Apply the following coil coating:

a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2604, except as modified below:

a) Humidity Resistance: 2000 hours.
b) Salt-Spray Resistance: 2000 hours.

2) Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:

a) Humidity Resistance: 2000 hours.
b) Salt-Spray Resistance: 2000 hours.

3) Color: [As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range].

I. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

J. Zinc Sheet: Electrolytic, 99 percent pure zinc alloyed with 1 percent titanium and copper.

1. Finish: Bright rolled.

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Nails for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch minimum and not less than 7/8 inch long, barbed with large head.
2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Solder for Lead-Coated Copper: ASTM B 32, Grade Sn60, 60 percent tin and 40 percent lead.

E. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

F. Solder for Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.

G. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

H. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

I. Burning Rod for Lead: Same composition as lead sheet.

J. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

K. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

L. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

M. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

N. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

O. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.

1. Manufacturers:

    a. Cheney Flashing Company, Inc.
    b. Fry Reglet Corporation.
    c. Heckmann Building Products Inc.
    d. Hickman, W. P. Company.
    e. Keystone Flashing Company, Inc.
    f. Sandell Manufacturing Company, Inc.
    g. Or an approved equal.

2. Material: Stainless Steel (thickness as indicated on the drawings).
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
7. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
8. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high end dams. Fabricate from the following material:

1. Lead-Coated Copper: 17.2 oz./sq. ft.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:

1. Lead-Coated Copper: 17.2 oz./sq. ft.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum stainless-steel and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.

3. Copper: Use copper, hardware bronze, or stainless-steel fasteners.
4. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
2. Pretinning is not required for lead-coated copper, zinc-tin alloy-coated stainless steel and lead.
3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
4. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
5. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
6. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
7. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24-inch centers.
2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.4 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 – ROOF ACCESSORIES

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 supports.
   2. Pipe and duct supports.
   3. Pipe portals.
   4. Preformed flashing sleeves.

B. Related Sections:

   1. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

D. Delegated-Design Submittal: For roof curbs and equipment supports 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 mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design **roof curbs and equipment supports** to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind-Restraint Performance: As indicated on Drawings.

2.2 EQUIPMENT SUPPORTS

A. Equipment Supports: Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed structure-mounting flange at bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Refer to M7.01 Equipment Schedule.

D. Material: Aluminum-zinc alloy-coated steel sheet, 0.052 inch thick.

1. Finish: Baked enamel or powder coat.
2. Color: As selected by Architect from manufacturer's full range.

E. Material: Aluminum sheet, 0.125 inch thick.

1. Finish: Baked enamel or powder coat.
2. Color: As selected by Architect from manufacturer's full range.

F. Construction:

1. Curb Profile: Manufacturer's standard compatible with roofing system.
2. Insulation: Factory insulated with 1-1/2-inch thick glass-fiber board insulation.
3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
4. Nailer: Factory-installed continuous wood nailers 3-1/2 inches under top flange on side of curb, continuous around support perimeter.
5. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
9. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
10. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.3 PIPE AND DUCT SUPPORTS

A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to 1-1/2-inch diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

B. Fixed-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand with polycarbonate roller carrying assembly accommodating up to 7-inch diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

C. Adjustable-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand base, pipe support, and roller housing, with stainless-steel threaded rod designed for adjusting support height, accommodating up to 18 inch diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

D. Adjustable-Height Structure-Mounted Pipe Supports: Extruded-aluminum tube, filled with urethane insulation; 2 inches in diameter; accommodating up to 7-inch diameter pipe or conduit, with provision for pipe retainer; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, stainless-steel roller and retainer, and extruded-aluminum carrier assemblies; as required for quantity of pipe runs and sizes.

2.4 PIPE PORTALS

A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snaplock swivel clamps.

B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless-steel snaplock swivel clamps.

2.5 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.

1. Metal: Aluminum sheet, 0.063 inch thick.
2. Diameter: As indicated on Drawings.
3. Finish: Manufacturer's standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Metal: Aluminum sheet, 0.063 inch thick.
2. Height: 7 inches (175 mm).
3. Diameter: As indicated on Drawings.
4. Finish: Manufacturer's standard.

2.6 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation and mill phosphatized for field painting where indicated.

1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
3. Exposed Coil-Coated Finish: Pre-painted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

4. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.

1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
2. Exposed Coil-Coated Finish: Pre-painted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

3. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
3. Clear Anodic Finish: AAMA 611 or thicker.
4. Color Anodic Finish: AAMA 611 or thicker.
5. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

6. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
7. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

D. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

E. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

F. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

G. Steel Tube: ASTM A 500/A 500M, round tube.

H. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

I. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.7 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, manufacturer's standard, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).

C. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated according to UL 972 with an average impact strength of 12 to 16 ft-lbf/in. (640 to 854 J/m) of width when tested according to ASTM D 256, Method A (Izod).

D. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.

E. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C), thickness as indicated.

F. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.

G. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

I. Underlayment:

1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
3. Slip Sheet: Building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum, rosin sized.
4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
5. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
6. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
7. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
8. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

J. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

K. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

L. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

M. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post according to manufacturer's written instructions.

F. Heat and Smoke Vent Installation:

1. Install heat and smoke vent so top perimeter surfaces are level.
2. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.

G. Gravity Ventilator Installation: Verify that gravity ventilators operate properly and have unrestricted airflow. Clean, lubricate, and adjust operating mechanisms.

H. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

I. Preformed Flashing-Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

J. Security Grilles: Weld bar intersections and, using tamper-resistant bolts, attach the ends of bars to structural frame or primary curb walls.

K. Roof Walkway Installation:

1. Verify that locations of access and servicing points for roof-mounted equipment are served by locations of roof walkways.
2. Remove ballast from top surface of low-slope roofing at locations of contact with roof-walkway supports.
3. Install roof walkway support pads prior to placement of roof walkway support stands onto low-slope roofing.
4. Redistribute removed ballast after installation of support pads.

L. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078443 – FIRESTOPPING

PART 1 - GENERAL

1.1 Applicable provisions of the Conditions of the Contract and Division #1, General Requirements, govern work in this Section.

1.2 DESCRIPTION OF WORK

A. The work of this Section consists of the provision of all materials, labor and equipment and the like necessary and/or required for the complete execution of all firestopping and smoke seal work for this project as required by the schedules, keynotes and drawings, including, but not limited to the following:

NOTE: Firestopping is defined as a material, or combination of materials, to restore the integrity of fire rated walls and floors by maintaining an effective barrier against the spread of flame, smoke and toxic gases and further defined in 1.4 below.

1. Provide firestopping and smoke seals as indicated on the drawings and/or required to maintain full and continuous smoke and fire barrier between zones including:

    a. Through penetration firestops and smoke-stops for all fire-rated bearing and non-bearing wall and floor assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes, ducts, etc.

NOTE: A preinstallation conference shall be scheduled by the Contractor with this Specialty Contractor and all other Specialty Contractors, Subcontractors and the like to establish procedures to maintain optimum working conditions and to coordinate the work of this Section with related and adjacent work.

1.3 RELATED WORK SPECIFIED ELSEWHERE – Entire Project Specification

NOTE: Proper execution of this work will maintain the hourly ratings of the walls and floors and ensure progress of work in other Sections as listed below.

1.4 QUALITY ASSURANCE

A. Firestopping systems (materials and design):

1. Shall conform to both Flame (F)P and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests in a configuration that is representative of field conditions.

2. The F rating must be a minimum of 1 hour but not less than the fire resistance rating of the assembly being penetrated.

3. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s).

4. The fire test shall be conducted with a minimum positive pressure differential of 0.03 inches of water column.

5. For joints, must be tested to UL 2079 or E 1399 and E 1966 with movement capabilities equal to those of the anticipated conditions.

6. Where there is no specific third party tested and classified firestop system available for a particular firestop configuration, the firestopping contractor shall obtain from the firestop manufacturer an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) for submittal.

B. Firestopping materials and systems must be capable of closing or filling through-openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical and mechanical duct work).

C. Firestopping sealants must be flexible, allowing for normal pipe movement.

D. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

E. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.

F. For firestopping exposed to view, traffic, moisture, and physical damage, provide appropriate firestop systems for these conditions.

G. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent possible).

H. Material used shall be in accordance with the manufacturer's written installation instructions.

I. Firestopping shall be performed by a Specialty Contractor trained or approved, in writing, by firestop material manufacturer. Said specialist shall be as defined in the Conditions. Equipment used shall be in accordance with firestop material manufacturer's written installation instructions.

J. Materials shall conform to all applicable governing codes.

K. All materials used in the work shall be certified "asbestos free" and shall be free from any and all solvents or components that require hazardous waste disposal or, that after curing, dissolve in water.

L. All materials shall comply with the interior finish flame spread and smoke developed requirements for the area in which they are installed./ Coordinate with governing codes.

M. DEFINITIONS

1. FIRESTOPPING: The use of a material or combination of materials in a fire-rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating on the wall or floor.

2. SYSTEM: The use of a specific firestop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s), constitutes a "system".

3. BARRIER: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.

4. THROUGH-PENETRATION: Any penetration of a fire-rated wall or floor that completely breaches the barrier.

5. MEMBRANE-PENETRATION: Any penetration in a fire-rated wall that breaches only one side of the barrier.

6. CONSTRUCTION GAPS: Any gap, joint, or opening, whether static or dynamic, where the top of a wall may meet a floor; wall to wall applications; edge to edge floor configurations; floor to exterior wall; or any linear breach in a rated barrier. Where movement is required, the firestopping system must comply with UL2079 for dynamic joints.

1.5 SUBMITTALS

NOTE: A “Certificate of Conformance”, from the manufacturer listed in Part 2, is required with the “Submittal Package” to ensure that the material selected meets all of the criteria of this specification as set forth in Paragraph 1.4 of this Section.

A. Submit manufacturer’s product literature for each type of firestop material to be installed. Literature shall indicate project characteristics, typical uses, performance and limitation criteria, and test data. Submittal should be in compliance with Section 013300.

B. UL Tested Systems: Submit drawings showing typical installation details for the methods of installation. Indicate which firestop materials will be used and thickness for different hourly ratings.

C. Engineering Judgments: Submit manufacturer’s drawings for all non-standard applications where no UL tested system exists. All drawings must indicate the “Tested” UL system upon which the judgment is based so as to assess the relevance of the judgment to some known performance.

D. Submit manufacturer’s installation procedures for each type of product.

E. Approved Applicator: Submit document from manufacturer where in manufacturer recognizes the installer as a qualified or submit a list of past projects to demonstrate capability to perform intended work.

F. Upon completion, installer shall provide written certification that materials were installed in accordance with the manufacturer’s installation instructions and details.

G. Mockups:

1. Prepare job mockup of the material proposed for use in the project as directed by Architect. Approved mockups shall be left in place as part of the finished project and will constitute the standard for remaining work, including aesthetics.

H. Manufacturers Material Safety Data Sheet (MSDS) must be submitted for each manufactured product.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver all materials to be used in the work of this section to the project site in original sealed containers with manufacturer’s brand and name, lot numbers, UL labeling, mixing and installation instructions clearly identified thereon.

B. Store all materials in accordance with manufacturer’s directions from the project site at the contractors expense if date is expired.

1.7 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. E 814 – Standard Method of Fire Tests of Through Penetration Fire Stops.

2. E 119 – Methods of Fire Tests of Building Construction and Materials.

3. E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

4. E 136 – Test Method for Behavior of Materials in a Vertical Tube Furnace at 750F.

5. E 1399 – Cyclic Movement and Measuring Minimum and Maximum Joint Widths.

6. E 1966 – Test Method for Resistance of Building Joint.

7. E 2174 – Standard Practice for On-Site Inspection of Installed Fire Stops.

8. E 05.11.14 – Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA); ASTM permanent number assignment pending approval of Draft.

B. Underwriters Laboratories, Inc. (UL)

1. UL 1479 – Fire Tests of Through Penetration Fire Stops.

2. UL 263 – Fire Tests of Building Construction and Materials.

3. UL 723 – Surface Burning Characteristics of Building Materials.

4. UL 2079 – Tests for Fire Resistance of Building Joint Systems.

5. UL “Fire Resistance Directory”, current year, including but not limited to the following:

   a. For penetrations by uninsulated, non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT) – UL System: CAJ1235, CAJ1404, WL1152.

   b. For penetrations by insulated, non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EAMT) – UL System: CAJ5222, CAJ5250, CAJ5251, WL5171.

   c. For penetrations by PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) – UL System: CAJU2401, CAJ3185, CAJ3199, CAJ3234, WL3118, WL3179, WL3199.

   d. For penetrations by combustible plastic pipe (open piping systems) – UL System: CAJ2174, CAJ2339, CAJ2351, CAJ2432, WL2168, WL2170, WL2185, WL2259.

e. For penetrations by multiple combustible and/or non-combustible items – UL System: CAJ8101, CAJ8133, WL8007.

f. For large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways – UL System: CAJ1406, CAJ1502, CAJ4053, CAJ6027, WJ6004, WL1207, WL1343, WL4030, WL6018.

g. For penetrations by steel ducts – UL System: CAJ7075, CAJ7082, WJ7045, WL7046, WL7006, WL7046, WL7081, WL7082.

h. For fire-rated construction joints and other gaps – OPL System: CEJ296P, CEJ302P.

6. For openings between structurally separate sections of wall and floors. At the top of walls – UL System: HWD0107, HWD0110, HWD0257, HWD0267, HWD0299, HWD0327, HWD0266, HWD 0333, HWD0334.

C. Factory Mutual (FM) Approval Guide, current year.

1. FM Approval Standard of Firestop Contractors – Class 4991.

D. Building code of the jurisdiction of the Work.

E. National Fire Protection Association

1. NFPA 101 – Life Safety Code.

2. NFPA 70 – National Electrical Code.

3. NFPA 221 – Fire Walls and Fire Barriers (preliminary to be released).

4. NFPA 251 – Fire Tests of Building Construction and Materials

F. FICA “Manual of Practice”.

G. Certification of “DRI” employee(s).

H. International Firestop Council (IFC):

1. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001)

2. Ref. 2 Inspectors Field Pocket Guide

1.8 PROJECT CONDITIONS

A. Conform to manufacturer’s printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.

B. Coordinate work required with work of other trades; firestopping shall, **where practical**, precede gypsum board or other applied sheet finishing operations.

C. Where firestopping is installed at locations which will remain exposed in the finished work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as required against damage from other construction operations.

1.9 SEQUENCING

A. Schedule firestopping after installation of penetrants but prior to concealing the openings.

1.10 PROTECTION

A. Where firestopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

PART 2 - PRODUCTS

2.1 GENERAL

A. Firestopping materials and systems shall meet the requirements specified herein.

B. Architect must approve in writing any alternates to the materials and systems specified herein.

C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.

D. For applications where combustible penetrants are involved, i.e., insulated and plastic pipe, a suitable intumescent material must be used.

2.2 SPECIFIED STANDARD: For purposes of establishing standards of quality and levels of performance and not for the purposes of limiting competition, the basis of this specification is upon units as manufactured by one of the following and their respective model suitable for the intended application.

A. Hilti, Inc.

B. Specified Technologies, Inc.

C. Grace / IPC Corp.

D. Nelson Firestop Products

E. Tremco, Inc.

F. U.S. Gypsum Company

G. Johns Manville

2.3 PRODUCTS SHALL GENERALLY INCLUDE:

A. Cast-In-Sleeves (3M CID).

B. Mortar seals.

C. Fire stop design sealant compounds, caulk and foam systems.

D. Putty and putty pads.

E. Firestop kits including collars, plugs, etc.

F. Seal bags.

G. Tapes and blankets.

H. Intumescent design wrap strips.

I. Mineral type unfaced safing insulation with third party wrap, 3.5 pcf density, UL R-10905 label.

2.4 ACCESSORY ELEMENTS

A. Forming, damming materials shall be mineral fiber board or other suitable material recommended by nominated system manufacturer.

B. Primers, sealant and solvent cleaners shall be as recommended by the nominated system manufacturer.

C. Metal Systems – 20 gauge phosphatized, electro-galvanized steel plate and/or galvanized steel clips.

2.5 Balance of materials shall be as specified elsewhere in this Section.

PART 3 – EXECUTION

3.1 INSPECTION AND ACCEPTANCE

A. Examine all surfaces and contiguous elements to receive work of this section and correct, as part of the Work of this Contract, any defects affecting installation. Commencement of work will be construed as complete acceptability of surfaces and contiguous elements.

B. Verify the environmental conditions are safe and suitable for installation of firestop products./

C. Verify that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.2 PREPARATION

A. The surface shall be dry, clean, and free of all foreign matter. Do not apply firestopping to surfaces previously painted or treated with a sealer, curing compound, water repellant or other coatings unless tests have been performed to ensure compatibility of materials.

B. Provide primers as required which conform to manufacturer's recommendations for various substrates and conditions.

C. Mask where necessary to protect adjoining surfaces.

D. Remove excess material and stains on surfaces as required.

3.3 INSTALLATION – GENERAL SYSTEMS

A. Install in strict accordance with manufacturer's printed instructions as well as UL guidelines and state and local fire codes.

B. Ensure that anchoring devices, backup materials, clips, sleeves, supports and other materials used in the actual fire test are installed.

C. Install firestopping with sufficient pressure to properly fill and seal openings to ensure an effective smoke seal.

D. Tool or trowel exposed surfaces. Remove excess firestop material promptly as work progresses and upon completion.

E. Install dams when required to properly contain firestopping materials within openings and as required to achieve required fire resistance ratings. Combustible damming materials must be removed after appropriate curing. Incombustible damming materials may be left as a permanent component of the firestopping system.

3.4 PENETRATION SEALS

A. Penetrations are defined as conduits, cables, wires, piping, ducts or other elements passing through one or both outer surfaces of fire rated walls, floors or partitions and shall be firestopped on both sides of penetration in accordance with requirements set forth in Paragraph 1.4 of this Section.

B. Where sleeves are used, same shall be as specified in Part 2 herein; in event that sleeves are not used, core openings and caulk or wrap penetrating items with intumescent system the full length of penetration and seal on both sides with intumescent caulk. Residual openings within square or rectangular holes shall be filled with compounds applicable for substrate encountered and all penetrations sealed on both sides with caulk.

3.5 FIELD QUALITY CONTROL

A. Contractor shall immediately notify the Architect if the firestopping systems herein specified cannot meet the requirements of the specification.

B. Contractor shall examine firestops to ensure proper installation and full compliance with this specification.

C. All areas of work must be accessible until inspection by the applicable Code authorities.

D. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

3.6 IDENTIFICATION

A. Identify firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

1. The words: “Warning—Firestop System—Do Not Disturb. Notify Building Management of Any Damage.”

2. Contractor’s name, address, and phone number.

3. Firestop system designation of applicable testing and inspecting agency.

4. Date of installation.

5. Firestop system manufacturer’s name.

6. Installer’s name.

3.7 CLEANING

A. When finished work will be visible, clean adjacent surfaces in accordance with manufacturer’s printed instructions.

B. If visible in the finished work, remove temporary dams after initial cure of firestops.

C. Correct staining and discoloring on adjacent surfaces.

D. Remove all debris and excess materials entirely from site and leave work in a neat and clean condition.

3.8 FIRESTOP SYSTEM SCHEDULE

A. The following schedules shall be completed by the Contractor and reviewed prior to submission to the Architect. The untitled table included shall be completed with each of the following categories of penetrating items.

1. Single uninsulated metallic piping and conduit.

2. Multiple uninsulated metallic piping and conduit.

3. Uninsulated plastic piping and conduit.

4. Insulated metallic piping.

5. Electrical cable.

6. Bus duct.

7. Miscellaneous penetrations.

B. Complete the additional tables for the following using the format provided.

1. Blanks, voids, holes.

2. Engineering judgments.

3. Ductwork engineering judgments.

3.09 WASTE MANAGEMENT

A. Separate and recycle materials and material packaging in accordance with Waste Management Plan and to the maximum extent economically feasible and place in designated areas for recycling.

B. Set aside and protect materials suitable for reuse and/or remanufacturing.

C. Separate and fold up metal banding; flatten and place along with other metal scrap for recycling in designated area.

PENETRATING ITEM:

Manufacturer/Product Name:
Color:
Accessories:

Floor/Wall Construction	Item Size/ Description	Sleeve	F Rating	T Rating	Annular Space	Firestop Thickness	Tested Ass'y No.

BLANKS, VOIDS, HOLES:

Manufacturer/Product Name:
Color:
Accessories:

Floor/Wall Construction	Size/ Description	F Rating	T Rating	Firestop Thickness	Tested Ass'y No.

ENGINEERING JUDGMENTS (Submit Actual Installation Drawing and Letter of Certification)

Manufacturer/Product Name:
Color:
Accessories:

Floor/Wall Construction	Item/Size Description	F Rating	T Rating	Annular Space	Firestop Thickness	Packing Thickness

DUCTWORK ENGINEERING JUDGMENTS (Submit Actual Installation Drawing and Letter of Certification

Manufacturer/Product Name:
Color:
Accessories:

Wall/Fl Construction	Size	Fire Damper	F	T	Annular Space Range	Firestop Thickness	Packing Thickness

END SECTION 078443

SECTION 079000 – JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joint sealants for exterior and interior surfaces.

2. Joint backup materials and accessories.

B. Related Documents:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. C 1193 - Guide for Use of Joint Sealants.

2. C 920 - Specification for Elastomeric Joints Sealants.

B. Sealant, Waterproofing and Restoration Institute (SWRI):

1. Sealants: The Professionals' Guide.

1.3 SUBMITTALS

A. Submit manufacturer's specification data include color chart for sealants.

B. Samples: Provide cured sample of approved color.

C. Sealant, Waterproofing & Restoration Institute (SWRI): provide Certificate of Validation for each elastomeric sealant.

D. Product Certificates and Test Report: Provide sealant certification and test report conforming to ASTM C 920.

E. Provide two (2) project references with installations of specified sealant.

1.4 QUALITY ASSURANCE

A. Obtain sealants from single manufacturer to ensure compatibility.

B. Applicator: Firm specializing in installing sealants with minimum ten (10) years experience in work of this Section. Provide manufacturer approved applicator certificate.

C. Manufacturer: Firm manufacturing specified product for a minimum of ten (10) years.

D. Perform work in accordance with SWRI Guide and ASTM C 1193.

E. Conduct preconstruction field adhesion tests for each application indicated with and without sealant primers.

1. Each type of elastomeric sealant and joint substrate indicated.

2. Install one-foot sealant samples with sealant primers. Sealant manufacturer shall conduct adhesion tests during preinstallation conference. Submit photos of adhesion tests.

2. Notify Owner seven (7) days in advance of dates and times when tests will be conducted.

3. Schedule sufficient time for testing and analyzing results to prevent delaying the work.

4. Submit report indicating results of adhesion tests.

F. Mock-ups: Before installing joint sealants, construct sealant mock-up to demonstrate aesthetics, effects, color and execution.

G. Preinstallation Conference: Conduct conference at project site with Owner, Contractor, Manufacturer, and Architect present.

H. Owner reserves the right to conduct additional Adhesion Tests during sealant installation. Contractor is responsible for replacing joint sealant in areas where quality control checks have been performed. If deficiencies are detected in the workmanship, two additional tests, per deficiency, will be performed and the Contractor will be responsible for replacing joint sealant in these new areas. Deficiencies must be corrected and at no cost to Owner.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products as recommended by manufacturer.

B. Deliver materials in sealed containers with manufacturer’s original labels attached.

1.6 PROJECT CONDITIONS

A. Do not apply sealants at temperatures below 40 degrees F. unless manufacturer is in agreement with cold weather application. Review Pecora Technical Bulletin Number 65.

1.7 SEQUENCING

A. Apply sealants, coordinating work with other trades and work, assuring uninterrupted sealant application and cure.

1.8 WARRANTY

A. Provide manufacturer's twenty (20) year material warranty.

B. Provide contractor's three (3) year labor guarantee against defective workmanship. Perform any repair under this guarantee at no cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. As a Basis of Design, details and specifications have been based on specified products by the following manufacturer:

1. Pecora Corporation, Harleysville, PA, 800-355-8817 ext. 6100.

a. Pecora 890NST Silicone Sealant conforming to ASTM C 920, Grade NS, Type S, Class 100, Non-Staining Technology.

b. Pecora 890FTS Field Tintable Silicone Sealant conforming to ASTM C 920, Grade NS, Class 100.

c. Pecora Dynatred Urethane Sealant conforming to ASTM C 920, Grade NS, Type M, Class 25%.

d. Pecora AC-20 Acrylic Latex Sealant conforming to ASTM C 834, Grade NS, Class 7 ½%

e. Pecora 898 Sanitary Silicone Sealant conforming to ASTM C 920, E 90 and C 919, Grade NS, Type S, Class 7 ½%.

2. Other acceptable manufacturers subject to compliance with requirements:

a. Bayer Corporation, Pittsburgh, Pennsylvania.

b. PSI, Elverson, Pennsylvania.

2.3 ACCESSORIES

A. Primers: Pecora Silicone Primers P-225 on porous surfaces and P-120 on non-porous surfaces, Urethane Primer P-75 on porous surfaces and P-120 on non-porous surfaces.

B. Joint Backup: Provide open-cell backer rod and/or bond breaker tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare surfaces to receive sealants in accordance with project specifications and manufacturer's instructions. Remove 100% of existing sealant and backer material.

B. Render surfaces clean of existing sealant residue and render joint sound.

C. Clean joints and surfaces to receive sealant of dust. Solvent wipe substrates using the two-rag method. Final cleaning of all surfaces should be done on the same day on which the sealant is applied.

D. Allow surfaces to dry completely before applying primer or sealant.

E. Apply recommended sealant primer as required by manufacturer.

3.2 APPLICATION

A. Apply sealants in accordance with manufacturer's specifications.

B. Install open-cell backer rod. Use a size compressed 25-30%. Use bond breaker tape in shallow joints when rod is not applicable.

C. Apply sealant with caulking gun, using proper nozzles. Use sufficient pressure to completely fill joints and ensure full contact of sealant to joint sides.

D. Tool all joints to eliminate air pockets and voids. Tool concave, unless otherwise notified. Dry tool all sealants.

E. Sealant Dimensions:

1. Silicone Sealant widths: existing joint width conditions apply. Sealant depth: maintain 3/8" sealant depth for joints 3/8" and wider. Joints less than 3/8" wide: provide equal sealant width and depth. Urethane Sealant widths: existing joint width conditions apply. Sealant depth: maintain 1/2" for joints 1/2" and wider. Joints less than 1/2" side: provide equal width and depth.

3.3 CLEANING

A. Remove sealant from adjacent surfaces immediately.

3.4 SCHEDULE

A. Exterior Joints required and included, but are not limited to the following:

1. Expansion & Control Joints, Window & Door Perimeters, Stone, Brick and Steel.

   Products: Pecora 890NST Silicone Sealant, 890FTS Silicone Sealant.

2. Interior and Exterior Floor Joints.

   Product: Pecora Dynatred Urethane Sealant.

   Product: Precora AC-20 Acrylic Latex Sealant.

3. Interior Acoustical Joints for Reduction of Sound Transmission.

Product: Pecora AIS-919 Acoustical Sealant.

END OF SECTION 079000

SECTION 230000 – MECHANICAL SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Work covered under Mechanical Contract.
2. Work under other contracts.
3. Use of premises.
4. Owner's occupancy requirements.
5. Specification formats and conventions.

B. Related Sections include the following:

1. Division 23 Sections.

1.3 WORK COVERED UNDER MECHANICAL CONTRACT

A. Provide all labor, materials, tools, machinery, equipment, and services necessary to complete the mechanical work under this contract. All systems and equipment shall be complete in every aspect and all items of material, equipment, and labor shall be provided for a fully operational system. Coordinate the work with work of other trades so as to resolve conflicts without impeding job progress. The mechanical work includes the following:

B. MECHANICAL

1. The mechanical contractor shall furnish all labor, materials, equipment, rigging, appliances, tools and accessories required for providing, installing, connecting and testing the new mechanical system, associated work, controls, etc., in accordance with these specifications and the applicable drawings. The work includes:

a. Remove existing HV/HVAC mechanical equipment as shown on the drawings, complete with associated ductwork, air inlets/outlets, dampers, louvers, piping, valves, insulation, supports, thermostats, electricals, controls, etc.

b. Remove existing HVAC units, complete with existing insulation, ductwork, outlets, supports, electrical, controls, thermostats, etc.

c. Remove existing exhaust fans, etc., complete with existing ductwork, air inlets/outlets, supports, electrical, controls, etc.

d. Remove existing ductwork and air inlets/outlets as called out on plans, complete existing dampers, insulation, supports, etc.

e. Remove existing piping as called out on the drawings, complete with existing insulation, valves, supports, etc.

f. Removed all existing controls and wiring associated with demolished mechanical equipment, thermostats, etc.

g. Remove existing controls on existing mechanical/HV/HVAC units throughout entire school as indicated on the drawings, complete with associated controls, control valves, actuators, thermostats, sensors, etc.

h. Remove all demolished equipment and debris from the site in accordance with all State and Local regulations.

i. Coordinate all removals as further scheduled on the drawings so as not to interfere with Owner's use of the building.

j. Furnish and install new HVAC unit as scheduled on the drawings, complete with spring vibration isolation roof curb, supports, VFD's, ductwork, insulation of all ductwork, air outlets/ inlets, dampers, DDC controls, etc. for a complete and operational system

k. Furnish and install new HV/HVAC mechanical equipment as scheduled on the plans, complete with new ductwork, piping, insulation, DDC controls, electrical, etc. for a complete and operational system.

l. Furnish and install three (3) Dx Split/Hot Water AHU as scheduled on the drawings, complete with hangers, supports, VFD's, ductwork, insulation of all ductwork, air outlets/ inlets, dampers, DDC controls, etc. for a complete and operational system.

m. Furnish and install new HVAC equipment, complete with piping, valves, insulation, supports, wiring, thermostats, electrical, DDC controls, etc. for a complete and operational system. Unit color to be selected by the owner.

n. Furnish and install new fan powered/hot water VAV, complete with piping, valves, insulation, supports, wiring, thermostats, disconnect switches, controls, etc. for a complete and operational system.

o. Furnish and install new exhaust fans complete with supports, vibration isolators, fan switch, interlock wiring, backdraft dampers, etc. for a complete and operational system.

p. **All electrical work associated with new HV/HVAC system shall be performed by the Electrical Subcontractor. Refer to electrical drawings and Division 26 specification sections for information.**

q. All electrical power supply work required for new DDC system shall be performed by the Electrical subcontractor. All low-voltage power supply and wiring work required for new DDC system shall be performed by the DDC control subcontractor.

r. Furnish and install new supply, return, exhaust and outdoor air ductwork as indicated on the drawings. All ductwork shall be galvanized steel construction.

s. Provide high-efficiency electric motors for all new units.

t. Furnish and install motorized dampers, volume dampers.

u. Furnish and install fire dampers of suitable rating at all duct penetrations through all rated partitions (walls/slab), whether indicated on the drawings or not.

v. Furnish and install flexible duct connectors at all duct connections to all HV/HVAC units.

w. Provide fire stopping for all duct and piping penetrations through rated walls/slabs with pipe escutcheons

x. Furnish and install supply and return piping, complete with manual shut-off/temperature balancing valves, check valves, control valves, temperature gauges, union connections, insulation, etc. for a complete operating system. Provide manual isolation valve (on supply) and manual balancing valve (on return) for each terminal unit connection.

y. Provide automatic and manual air vents at the top of piping risers/headers, at high points in the system.

z. All cutting, patching and alteration work shall be performed.

aa. Furnish and install all ancillary equipment needed for a complete and proper installation including, but not limited to anchors, hangers, expansion loops, fittings, strainers, valves, unions, etc.

bb. All ductwork shall be properly fabricated, installed and supported as per SMACNA and ASHRAE guidelines

cc. Contractor to perform testing, adjusting and balancing (TAB) of the entire HV/HVAC system shown on the drawings, including all new HV/HVAC units, air and water side distributions, air outlets/inlets, etc. **Submit four (4) sets of air and unit TAB reports for review.**

dd. Provide testing, commissioning and start-up reports for all new mechanical/HV system installed in this project.

ee. The entire new piping system shall be hydrostatically tested for a minimum of two (2) hours at a minimum of 150 psig or 1.5 times the working pressure, whichever is higher. **Submit four (4) sets of pressure testing report for review.**

ff. Submit six (6) sets of shop drawings of all equipments, sheet metal standards, piping standards, equipment layout, detailed duct and piping layouts, air inlets, supports, DDC controls, electrical, wiring diagram, etc.

gg. Contractor to prepare as-built drawings of the entire mechanical/HV system. **Submit four (4) sets of Operation and Maintenance Manuals**.

hh. Contractor to perform testing, adjusting and balancing (TAB) of the entire HVAC/HV/Mechanical system, including all new HVAC units, air side distribution, air outlets/inlets, water side distribution, finned tube elements/baseboards, etc. TAB on new rooftop units shall include detailed performance verification (cooling capacity, heating capacity, individual pressure drops, amp readings, CFM's, etc.) which will need to be done during respective cooling, heating, and transitional seasons. **Submit four (4) sets of air, water and unit TAB reports for review**.

ii. Detailed Performance Testing, Adjusting and Balancing (TAB) shall be done during the respective season for the units, during the summer season for cooling mode, during winter for heating mode, and during fall/spring for free cooling mode.

jj. Provide color coded identification tags, identification markers and equipment tags for all equipment including HVAC units, fans, ductwork, piping, valves, control valves, etc.

kk. Warranty: The entire system shall be warranted for a period of two (2) complete years from the date of acceptance by the owner, including all materials and labor components.

ll. **Commissioning:** The following is the commissioning scope of work for this project:

1. There will not be a separate commissioning agent on this project. The architect/engineer will oversee the commissioning process.

2. Submittals/Shop Drawings shall include detailed start up procedures.

3. All equipment shall be factory tested before being shipped to project site.

4. Perform functional performance test (FPT) of all HV/HVAC systems and equipment. Submit FPT Reports.

5. Provide detailed Start-Up Reports.

6. Trending: The building control system/energy management system, shall be monitored for the first year by the Controls Contractor, as well as by the Owner/Owner designated team for proper operation to optimize energy performance without compromising the comfort conditions.

7. The contractor shall certify in writing that the entire work was completed, and systems are operational according to the contract documents, including calibration of instrumentation and controls.

8. Schedule, witness and document tests, inspections and systems startup. Inform architect/engineer sufficiently in advance to enable them to witness startup.

9. Perform testing, adjusting and balancing of all airside, waterside, and units/systems.

10. Compile test data, inspection reports and certificates and include them in the Systems Manual and Commissioning Report.

11. Certify date of acceptance and startup for each item of equipment for start of warranty periods.

12. Prepare as-built drawings. Submit four (4) sets of each, along with two (2) CD's (for drawings).

13. Conduct Operation and Maintenance Training Programs, to be provided by qualified instructors for all HV/HVAC systems and equipment. Videotape and edit training sessions. Submit two (2) videotapes for Owners future use and reference.

14. Submit six (6) sets of all documents.

1.4 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.5 USE OF PREMISES

A. General: Each Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.

2. Driveways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the

Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.

2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.

2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.

3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed.

1.7 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI/CSC's "Master Format" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be

performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.8 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 230000

SECTION 230500 – COMMON WORK RESULTS 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. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Mechanical demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.

2. Dielectric fittings.

3. Mechanical sleeve seals.

4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

1. Acceptable Manufacturers:
   a. Capitol Manufacturing Co.
   b. Eclipse, Inc.
   c. Epco Sales, Inc.
   d. Hart Industries, International, Inc.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Industries, Inc.; Wilkins Div.
   g. Or Approved Equal.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

1. Acceptable Manufacturers:
   a. Capitol Manufacturing Co.
   b. Epco Sales, Inc.
   c. Watts Industries, Inc.; Water Products Div.
   d. Or Approved Equal.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Acceptable Manufacturers:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Pipeline Seal and Insulator, Inc.
   d. Or Approved Equal.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Acceptable Manufacturers:

a. Calpico, Inc.

b. Lochinvar Corp.

c. Epco Sales, Inc.

d. Or Approved Equal.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Acceptable Manufacturers:

a. Perfection Corp.

b. Precision Plumbing Products, Inc.

c. Sioux Chief Manufacturing Co., Inc.

d. Victaulic Co. of America.

e. Or Approved Equal.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Acceptable Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Metraflex Co.

d. Pipeline Seal and Insulator, Inc.

e. Or Approved Equal.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated and rough brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated and rough brass.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.8 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

5. Equipment to Be Removed: Disconnect and cap services and remove equipment.

6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. 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.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:
    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
    g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
    h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
    j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
    l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
2. Existing Piping: Use the following:

a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.

b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.

c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.

f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.

g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.

h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.

i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.

j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.

k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. PVC Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).

b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 09 Sections "Interior Painting"

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout around anchors.

G. Cure placed grout.

END OF SECTION 230500

SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC 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 ac power systems up to 600V 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 HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe duty motors.

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: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. 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.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse width modulated inverters.

2. Energy and Premium Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable torque, permanent split capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230523 – GENERAL-DUTY VALVES 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following general-duty valves:

1. Copper-alloy ball valves.
2. Ferrous-alloy ball valves.
3. Bronze check valves.
4. Ferrous-alloy wafer check valves.
5. Spring-loaded, lift-disc check valves.
6. Bronze gate valves.
7. Cast-iron gate valves.
8. Bronze globe valves.
9. Cast-iron globe valves.

B. Related Sections include the following:

1. Division 23 Section "Mechanical Identification" for valve tags and charts.
2. Division 23 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. SWP: Steam working pressure.
6. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.

1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

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 handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:
1. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
2. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.

a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.

2. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.3 COPPER-ALLOY BALL VALVES

A. Available Manufacturers:

B. Manufacturers:

1. One-Piece, Copper-Alloy Ball Valves:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Div.
c. Grinnell Corporation.
d. Jamesbury, Inc.
e. Kitz Corporation of America.
f. Legend Valve & Fitting, Inc.
g. NIBCO INC.
h. Watts Industries, Inc.; Water Products Div.
i. Or Approved Equal.

C. Copper-Alloy Ball Valves, General: MSS SP-110.

D. One-Piece, Copper-Alloy Ball Valves: Brass or bronze body with chrome-plated bronze ball, PTFE or TFE seats.

2.4 FERROUS-ALLOY BALL VALVES

A. Available Manufacturers:

B. Manufacturers:

1. American Valve, Inc.
2. Conbraco Industries, Inc.; Apollo Div.
3. Cooper Cameron Corp.; Cooper Cameron Valves Div.
4. Flow-Tek, Inc.
5. Foster Valve Co.
6. Kitz Corporation of America.
7. KTM Products, Inc.
8. McCANNA, Incorporated.
9. Milwaukee Valve Company.
10. NIBCO INC.
11. PBM, Inc.
12. Richards Industries; Marwin Ball Valves.
13. Worcester Controls.
14. Or Approved Equal.

C. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.

D. Ferrous-Alloy Ball Valves: Class 150, full or regular port.

2.5 BRONZE CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:

a. Cincinnati Valve Co.
b. Red-White Valve Corp.
c. Walworth Co.
d. Or Approved Equal.

2. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:

a. Cincinnati Valve Co.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Red-White Valve Corp.
d. Or Approved Equal.

3. Type 3, Bronze, Swing Check Valves with Metal Disc:

a. American Valve, Inc.
b. Cincinnati Valve Co.
c. Kitz Corporation of America.
d. Legend Valve & Fitting, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell, Wm. Co.

h. Red-White Valve Corp.
i. Walworth Co.
j. Watts Industries, Inc.; Water Products Div.
k. Or Approved Equal.

C. Bronze Check Valves, General: MSS SP-80.

D. Type 1, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.

E. Type 1, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.

F. Type 3, Class 150, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

2.6 FERROUS-ALLOY WAFER CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Gulf Valve Co.
c. Valve and Primer Corp.
d. Or Approved Equal.

2. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Gulf Valve Co.
c. Techno Corp.
d. Or Approved Equal.

C. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.

D. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

2.7 SPRING-LOADED, LIFT-DISC CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type I, Wafer Lift-Disc Check Valves:

a. Mueller Steam Specialty.

2. Type II, Compact-Wafer, Lift-Disc Check Valves:

a. Durabla Fluid Technology, Inc.
b. Flomatic Valves.

c. GA Industries, Inc.
d. Grinnell Corporation.
e. Metraflex Co.
f. Milwaukee Valve Company.
g. Mueller Steam Specialty.
h. Multiplex Manufacturing Co.
i. NIBCO INC.
j. SSI Equipment, Inc.
k. Val-Matic Valve & Mfg. Corp.
l. Valve and Primer Corp.
m. Or Approved Equal.

3. Type III, Globe Lift-Disc Check Valves:

a. Durabla Fluid Technology, Inc.
b. Flomatic Valves.
c. GA Industries, Inc.
d. Grinnell Corporation.
e. Metraflex Co.
f. Milwaukee Valve Company.
g. Multiplex Manufacturing Co.
h. NIBCO INC.
i. SSI Equipment, Inc.
j. Val-Matic Valve & Mfg. Corp.
k. Valve and Primer Corp.
l. Or Approved Equal.

4. Type IV, Threaded Lift-Disc Check Valves:

a. Check-All Valve Mfg. Co.
b. Durabla Fluid Technology, Inc.
c. Grinnell Corporation.
d. Legend Valve & Fitting, Inc.
e. Metraflex Co.
f. Milwaukee Valve Company.
g. Mueller Steam Specialty.
h. NIBCO INC.
i. Watts Industries, Inc.; Water Products Div.
j. Or Approved Equal.

C. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

D. Type I, Class 125, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.

E. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.

F. Type III, Class 125, Globe Lift-Disc Check Valves: Globe style with cast-iron shell and flanged ends.

G. Type IV, Class 125, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

2.8 BRONZE GLOBE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 1, Bronze Globe Valves with Metal Disc:

a. Cincinnati Valve Co.
b. Grinnell Corporation.
c. Kitz Corporation of America.
d. Legend Valve & Fitting, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell, Wm. Co.
h. Red-White Valve Corp.
i. Walworth Co.
j. Or Approved Equal.

2. Type 2, Bronze Globe Valves with Nonmetallic Disc:

a. Cincinnati Valve Co.
b. Grinnell Corporation.
c. Kitz Corporation of America.
d. McWane, Inc.; Kennedy Valve Div.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell, Wm. Co.
h. Red-White Valve Corp.
i. Walworth Co.
j. Or Approved Equal.

3. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:

a. Cincinnati Valve Co.
b. Grinnell Corporation.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Walworth Co.
f. Or Approved Equal.

C. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy hand wheel.

D. Type 1, Class 150, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.

E. Type 3, Class 150, Bronze Globe Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.

2.9 CAST-IRON GLOBE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type I, Cast-Iron Globe Valves with Metal Seats:

    a. Cincinnati Valve Co.
    b. Grinnell Corporation.
    c. Kitz Corporation of America.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Powell, Wm. Co.
    g. Red-White Valve Corp.
    h. Walworth Co.
    i. Or Approved Equal.

C. Cast-Iron Globe Valves, General: MSS SP-85.

D. Type I, Class 125, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. 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.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. 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.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves.
2. Throttling Service: Ball or globe valves.
3. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Heating Water Piping: Use the following types of valves:
   1. Ball Valves, NPS 2 (DN 50) and Smaller: One or Two-piece, CWP rating, copper alloy.
   2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
   3. Lift Check Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, horizontal / vertical, bronze.
   4. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
   5. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.
   6. Wafer Check Valves, NPS 2-1/2 (DN 65) and Larger: Single / Dual-plate, wafer-lug/ double-flanged, Class 150, ferrous alloy.
   7. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 150.
   8. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Class 125, cast iron.
   9. Gate Valves, NPS 2 (DN 50) and Smaller: Type 2 / 3, Class 150, bronze.
   10. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, OS&Y, bronze-mounted cast iron.
   11. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
   12. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves NPS 4 (DN 100) and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
   3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 230523

SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC 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. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

B. Related Sections:

1. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC 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.

3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.

2. Metal framing systems.

3. Fiberglass strut systems.

4. Pipe stands.

5. Equipment supports.

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. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Pre-galvanized or hot-dipped.

3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or [ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: 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.

B. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless-] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

2. Base: Stainless steel.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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 A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) 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.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. 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 (DN 65) 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.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.
    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 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 (40 mm).

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting".

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 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 finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: 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 noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).

12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. 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 24 (DN 24 to DN 600).

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

L. Building Attachments: 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. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary, to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230553 – MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.

2. Equipment markers.

3. Equipment signs.

4. Access panel and door markers.

5. Pipe markers.

6. Duct markers.

7. Stencils.

8. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Valve numbering scheme.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

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 location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:

a. Manufacturer, product name, model number, and serial number.
b. Capacity, operating and power characteristics, and essential data.
c. Labels of tested compliances.

2. Location: Accessible and visible.

3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.

2. Data:

a. Name and plan number.
b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.

2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.

3. Thickness: 1/8 inch, unless otherwise indicated.

4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.

5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.

2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.

4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.

5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pre-tensioned Pipe Markers: Precoiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.

2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.3 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

1. Stencil Material: Metal or fiberboard, Aluminum, or Brass.

2. Stencil Paint: Exterior, gloss, acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch thick brass or aluminum.

2. Material: 0.0375-inch thick stainless steel.

3. Material: 3/32-inch thick laminated plastic with 2 black surfaces and white inner layer.

4. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.6 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size 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-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.

2. Frame: Extruded aluminum.

3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Motor-driven units.

2. Heat exchangers, coils, evaporators, and similar equipment.

3. Fans, blowers, primary balancing dampers, and mixing boxes.

4. Packaged HV/HVAC (central-station and zone-type units), split HV/HVAC, indoor AHU’s, etc.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 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.

2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:

a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
b. Meters, gages, thermometers, and similar units.
c. Fuel-burning units, including boilers, furnaces, and heaters.
d. Fans, blowers, primary balancing dampers, and mixing boxes.
e. Packaged HV/HVAC (central-station and zone-type units), split HV/HVAC, indoor AHU's, etc.
f. Strainers, filters, water-treatment systems, and similar equipment.

C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:

a. Green: For cooling equipment and components.
b. Yellow: For heating equipment and components.
c. Green and Yellow or Orange: For combination cooling and heating equipment and components.

2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 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.

3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

4. Include signs for the following general categories of equipment:

a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
b. Heat exchangers, coils, evaporators, and similar equipment.
c. Fans, blowers, primary balancing dampers, and mixing boxes.
d. Packaged HV/HVAC (central-station and zone-type units), split HV/HVAC, indoor AHU's, etc.
e. Strainers, filters, water-treatment systems, and similar equipment.

E. Stenciled Equipment Sign Option: Stenciled signs may be provided instead of laminated-plastic equipment signs, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

F. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.

2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.

B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers with painted, color-coded bands or rectangles complying with ASME A13.1 on each piping system.

1. Identification Paint: Use for contrasting background.

2. Stencil Paint: Use for pipe marking.

C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.

4. At access doors, manholes, and similar access points that permit 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 markers.

3.4 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:

1. Green: For cold-air supply ducts.

2. Yellow: For hot-air supply ducts.

3. Blue: For exhaust, outside, relief, return, and mixed-air ducts.

4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

5. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 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.

B. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow, may be provided instead of laminated-plastic duct markers, at Installer's option, if lettering larger than 1-inch high is needed for proper identification because of distance from normal location of required identification.

C. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.6 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.7 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

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. Balancing Air Systems:

a. Constant-volume air systems.

2. Balancing Hydronic Piping Systems:

a. Constant-flow hydronic systems.

3. Additional Tests

a. Sound testing.
b. Vibration testing.
c. Duct leakage testing.
d. Controls verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. T&B: Testing, adjusting, and balancing

C. T&B Agency: An independent entity certified by AABC to perform testing and balancing work.

D. TBE: AABC certified test and balance engineer.

E. TBT: AABC certified test and balance technician.

F. HVAC: Heating, ventilating, and air conditioning.

G. BAS: Building automation systems.

H. Contract documents: the mechanical drawings and test and balance specification

I. NC: noise criteria

J. RC: room criteria

1.4 T&B INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation T&B of AABC certification of T&B agency and personnel, including a sample copy of the AABC "National Performance Guaranty." If not submitted within the timeframe specified, the engineer has the right to choose an AABC agency at the Contractor’s expense.

B. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit T&B strategies and step-by-step procedures as specified in "Preparation" Article.

C. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article to be used and filled out by systems Installers verifying that systems are ready for T&B.

D. Examination Report: Within 30 days of Contractor's Notice to Proceed, provide a summary report of the examination review required in Part 3 “Examination”, if issues are discovered that may preclude the proper testing and balancing of the systems.

E. Certified T&B reports: Within 14 days of completion of balancing work, submit AABC-certified T&B report.

1. Submit one copy of the final T&B Report directly to the design professional of record. Provide five additional copies to the contractor.

1.5 QUALITY ASSURANCE

A. T&B Agency Qualifications: Engage a T&B entity certified by AABC.

1. T&B Field Supervisor: Employee of the T&B Agency who is certified by AABC.
2. T&B Technician: Employee of the T&B Agency and who is certified by AABC as a TBT.

B. T&B Conference: If requested by the Engineer or Owner after approval of the T&B Agency’s submittals, meet to develop a mutual understanding of the details. The T&B agency shall be provided a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The examination report.
b. The Strategies and Procedures plan.
c. Systems readiness checklists.
d. Coordination and cooperation of trades and subcontractors.
e. Coordination of documentation and communication flow.

C. TBT shall perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified T&B reports.
2. Certify that the T&B team complied with the approved T&B plan and the procedures specified and referenced in this Specification.
3. Certify the T&B report.

D. T&B Report Forms: Use approved forms submitted with the Strategies and Procedures Plan.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in the "AABC National Standards for Total System Balance."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire T&B period. Cooperate with Owner during T&B operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during T&B operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 T&B AGENCY

A. Subject to compliance with requirements, engage one of AABC certified T&B Agencies:

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper T&B of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Note the locations of devices that are not accessible for testing and balancing.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

E. Examine equipment performance data including fan and pump curves.

F. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and equipment with functioning controls is ready for operation.

G. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the controls contractor, and functioning.

H. Examine strainers to verify that mechanical contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.

I. Examine two-way valves for proper installation and function.

J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.

3.3 PREPARATION

A. Prepare a T&B 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. Prepare system-readiness checklists, as described in the "AABC National Standards for Total System Balance," for use by systems installers in verifying system readiness for T&B. These shall include, at a minimum, the following:

1. Airside:

a. Ductwork is complete with terminals installed.
b. Volume, smoke and fire dampers are open and functional.
c. Clean filters are installed.
d. Fans are operating, free of vibration, and rotating in correct direction.
e. Variable-frequency controllers' start-up is complete and safeties are verified.
f. Automatic temperature-control systems are operational.
g. Ceilings are installed.
h. Windows and doors are installed.
i. Suitable access to balancing devices and equipment is provided.

2. Hydronics:

a. Piping is complete with terminals installed.
b. Water treatment is complete.
c. Systems are flushed, filled and air purged.
d. Strainers are pulled and cleaned.
e. Control valves are functioning per the sequence of operation.
f. Shutoff and balance valves have been verified to be 100 percent open.
g. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for T&B procedures.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP)units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare single-line schematic diagram of systems for the purpose of identifying HVAC components.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check condensate drains for proper connections and functioning.

H. Check for proper sealing of air-handling-unit components.

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.

    a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
    b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the 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.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report any artificial loading of filters at the time static pressures are measured.

3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-

motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust sub-main and branch duct volume dampers for specified airflow. Re-measure each sub-main and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure airflow at all inlets and outlets.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after all have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust, if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for coils and heat exchangers. Obtain approved submittals and any manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

B. Verify that hydronic systems are ready for testing and balancing:

1. Check that makeup water-has adequate pressure to highest vent.
2. Check that control valves are in their proper position.
3. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
4. Verify that motor starters are equipped with properly sized thermal protection.
5. Check that air has been purged from the system.

C. Adjust flow measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.

D. Adjust flow measuring devices installed at terminals for each space to design water flows.

1. Measure flow at all terminals.
2. Adjust each terminal to design flow.

3. Re-measure each terminal after all have been adjusted.
4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after all flows have been balanced.

E. For systems with pressure-independent valves at the terminals:

1. Measure differential pressure and verify that it is within manufacturer’s specified range.
2. Perform temperature tests after all flows have been verified.

F. For systems without pressure-independent valves or flow measuring devices at the terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.
2. If balanced by coil pressure drop, perform temperature tests after all flows have been verified.

G. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure all final pumps' operating data, TDH, volts, amps, static profile.
3. Mark all final settings.

H. Verify that all memory stops have been set.

3.8 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phse/Hertz (Hz)
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test the manual bypass of the controller to prove proper operation.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, fan-coil units, etc.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.10 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.11 FINAL TEST AND BALANCE REPORT

A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the T&B process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. All measurements and test results that appear in the reports must be made on site and dated by the AABC technicians or test and balance engineers.

B. The report must be organized by systems and shall include the following information as a minimum:

1. Title Page:

a. AABC certified company name
b. Company address
c. Company telephone number
d. Project identification number
e. Location
f. Project Architect
g. Project Engineer
h. Project Contractor
i. Project number

j. Date of report
k. AABC Certification Statement
l. Name, signature, and certification number of AABC TBE

2. Table of Contents.
3. AABC National Performance Guaranty.
4. Report Summary:

a. The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.

5. Instrument List:

a. Type.
b. Manufacturer.
c. Model.
d. Serial Number.
e. Calibration Date.

6. T&B Data:

a. Provide test data for specific systems and equipment as required by the most recent edition of the "AABC National Standards."

C. One copy of the final test and balance report shall be sent directly to the engineer of record. Provide five additional copies to the contractor.

3.12 VERIFICATION OF T&B REPORT

A. Final Verification:

1. After testing and balancing is complete and accurately documented in the final report, request that a final verification be made by Engineer.
2. The T&B Agency shall conduct the verification in the presence of Engineer.
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final verification, the testing and balancing shall be considered incomplete.

3.13 REVERIFICATION

A. T&B Agency shall recheck all measurements and make adjustments as required to complete the balancing. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second verification.

B. If the second verification also fails, Owner/Engineer may contact AABC Headquarters regarding the AABC National Performance Guaranty.

3.14 ADDITIONAL TESTS

A. Sound Testing

1. After the systems are balanced and the spaces are architecturally complete, read and record sound levels at 10 locations as designated by the Engineer of record.
2. Instrumentation:

    a. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
    b. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels, and measuring the equivalent continuous sound pressure level (LEQ).
    c. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 HZ to 8000 HZ.
    d. The accuracy of the sound-testing meter shall be ±1 decibel.

3. Test Procedures

    a. Perform test at the quietest background noise period. Note any cause of unpreventable sound that may affect the test outcome.
    b. Equipment should be operating at design values.
    c. Calibrate the sound-testing meter prior to taking measurements.
    d. Use a microphone suitable for the type of noise levels measured that is compatible with the meter. Provide a windshield for outside or in-duct measurements.
    e. Record a set of background measurements in dB(A), and sound pressure levels in the eight un-weighted octave bands [63 HZ to 8000 HZ (NC)] with the equipment off.
    f. Take sound readings in dB(A), and sound pressure levels in the eight un-weighted octave bands [63 HZ to 8000 HZ (NC)] with the equipment on.
    g. Take readings no closer than 3’ from a wall or from the operating equipment, and approximately 5’ from the floor, with the meter held or mounted on a tripod.
    h. For outdoor measurements, move the sound-testing meter slowly and scan the area that has the greatest exposure to the noise source being tested. (This type of reading is generally performed using the A-Weighted scale).

4. Reporting

    a. The report must record: the location, the system tested, the dB(A) reading, and the sound pressure level in each octave band with equipment on and off.
    b. Plot all the sound pressure levels on the NC work sheet, with the equipment on and off.

B. Vibration Testing:

1. After the systems are balanced and the spaces are architecturally complete, read and record vibration levels on all equipment with motor horsepower equal to or greater than 10 hp.
2. Instrumentation:

    a. The vibration meter should be portable, battery-operated, and microprocessor-controlled, with or without a built-in printer.
    b. The meter shall automatically identify engineering units, filter bandwidth, amplitude and frequency scale values.

c. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.

3. Test Procedures:

a. Verify that the vibration meter calibration date is current before taking readings.
b. To ensure accurate readings, verify that the accelerometer has a clean, flat surface and is mounted properly.
c. With the unit running, set up the vibration meter in a safe, secure location. Connect the transducer to the meter with the proper cables. Hold the magnetic tip of the transducer on top of the bearing, and measure the unit in mils of deflection. Record the measurement, then move the transducer to the side of the bearing, and record in mils of deflection. Record an axial reading in mils of deflection by holding the nonmagnetic, pointed transducer tip on the end of the shaft.
d. Change the vibration meter to velocity (inches per second) measurements. Repeat and record the above measurements.
e. Record the CPM or the RPM.
f. Read each bearing on the motor, fan, and/or pump as required. Track and record vibration levels from the rotating component through the casing to the base.

4. Reporting

a. The report must record the location and the system tested.
b. Include horizontal-vertical-axial measurements for all tests.
c. Verify that vibration limits follow specifications, or, if not specified, follow the “General Machinery Vibration Severity Chart” or “Vibration Acceleration General Severity Chart” from the AABC National Standards. Acceptable levels of vibration are normally “Smooth” to “Good.”
d. Include in the report the Machinery Vibration Severity Chart, with conditions plotted.

C. Duct Leakage Testing:

1. Witness the duct pressure testing performed by the mechanical/installing contractor.
2. Verify that proper test methods are used and that leakage rates are within specified tolerances.
3. Report any deficiencies observed.

D. Controls Verification

1. In conjunction with system balancing perform the following:

a. Work with the temperature control contractor to ensure the system is operating within the design limitations, and gain a mutual understanding of intended control performance.
b. Confirm that the sequences of operation are in compliance with the approved drawings.
c. Verify that controllers are calibrated and function as intended.
d. Verify that controller setpoints are as specified.
e. Verify the operation of lockout or interlock systems.
f. Verify the operation of all valve and damper actuators.
g. Verify that all controlled devices are properly installed and connected to the correct controller.

h. Verify that all controlled devices travel freely and are in the position indicated by the controller: open, closed, or modulating.
i. Verify the location and installation of all sensors to ensure they will sense only the intended temperatures, humidities, or pressures.

2. Reporting

a. The report shall include a summary of verifications performed, remaining deficiencies, and any variations from specified conditions.

END OF SECTION 230593

SECTION 230713 – DUCT 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 duct services:

1. Indoor, concealed supply, return & exhaust air.
2. Indoor, concealed ductwork located in unconditioned space.

B. Related Sections:

1. Section 230719 “Piping Insulation.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. 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 insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

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, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, 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.

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 Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

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. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, factory-applied FSK jacket/FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article

2.2 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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
2. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
4. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 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: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches (75 mm).

2. Thickness: 11.5 mils (0.29 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches (75 mm).
2. Thickness: 6.5 mils (0.16 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Width: 2 inches (50 mm).
2. Thickness: 6 mils (0.15 mm).
3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches (50 mm).
2. Thickness: 3.7 mils (0.093 mm).
3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.8 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, [Type 304] [or] [Type 316]; 0.015 inch (0.38 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with wing seal.
2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with wing seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated.

2. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
b. Spindle: Copper- or zinc-coated, low-carbon steel/Aluminum, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel/aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.080-inch (2.0-mm) soft-annealed, galvanized 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. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

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 ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct 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. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended 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 at attachment 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 by insulation material manufacturer.

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- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to 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 duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 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 (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof 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 roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, supply-air, return-air, exhaust-air and outdoor-air duct insulation shall be the following:

1. Mineral Fiber Blanket: Minimum R-6, 1-1/2 inches thick, and minimum 1 lb. density.

END OF SECTION 230713

SECTION 230714 – ACOUSTIC DUCT INSULATION

PART 1 – GENERAL

1.01 SCOPE

A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for correct fabrication and installation of fibrous glass duct liner in sheet metal ducts in accordance with applicable project drawings and specifications, subject to terms and conditions of the contract:

1. All air duct systems operating at internal air velocities not exceeding rated duct liner limitations as listed below, and internal air temperatures not exceeding 250°F.

B. The finished duct system shall meet the requirements of NFPA 90A and 90B.

C. Dimensions shown on the plans are finished inside dimensions.

D. Fabrication and installation shall conform to manufacturer's recommendations and to the requirements of the latest edition of North American Insulation Manufacturers Association (NAIMA) Fibrous Glass Duct Liner Standards, hereinafter referred to as NAIMA FGDLS, and/or Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Standard, HVAC Duct Construction Standards – Metal and Flexible, hereinafter referred to as SMACNA HVAC DCS.

1.02 REFERENCES

A. Duct liner insulation materials shall meet the requirements of the following:

1. American Society for Testing and Materials specifications:

a. ASTM C 1071, Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).

1.03 DELIVERY AND STORAGE OF MATERIALS

A. Deliver all materials and/or fabricated, insulated duct sections and fittings to the job site and store in a safe, dry place.

B. Use all means necessary at the job site to protect materials from dust, dirt, moisture and physical abuse before and during installation.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive,

mastic, tapes, and cement material containers, 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.

PART 2 – PRODUCTS

2.01 INSULATED DUCT SYSTEM

A. All supply ducts, return ducts and related fittings shall be insulated with one of the following as designated on project plans and specifications:

1. Owens Corning QuietR® Textile Duct Liner, for service at internal air velocities not to exceed 6,000 fpm:

a. Type 200, 1-1/2" thick.

The duct liner shall have a black pigmented coating on the airstream side to resist damage during installation and in service. Edges shall be factory coated with the same black pigmented coating to comply with SMACNA HVAC DCS.

2. Owens Corning QuietR® Rotary Duct Liner, for service at internal air velocities not to exceed 6,000 fpm (30.5 m/s):

a. Type R-6, 1-1/2" (38mm) thick.

The duct liner shall have a black pigmented coating on the airstream side to resist damage during installation and in service. Edges shall be factory coated with the same black pigmented coating to comply with SMACNA HVAC DCS.

3. Owens Corning Quiet® Duct Liner Board, for service at internal air velocities not to exceed 6,000 fpm (30.5 m/s):

a. 3.0 pcf (48 kg/m3) density, 1-1/2" thick.

The duct liner shall have a black pigmented mat on the airstream side to resist damage during installation and in service. Edges shall be factory coated with black pigmented coating to comply with SMACNA HVAC DCS requirements.

PART 3 – EXECUTION

3.01 INSPECTION

A. Verify that the duct liner product may be installed in accordance with project drawings, operating performance parameters and limitations, and NAIMA FGDLS or SMACNA HVAC DCS.

3.02 INSULATION OF STRAIGHT DUCT AND FITTINGS

A. All portions of duct designated to receive duct liner shall be completely covered with duct liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. The black pigmented or mat faced surface of the duct liner shall face the airstream.

B. Duct liner shall be adhered to the sheet metal with 90% coverage of adhesive complying with requirements of ASTM C 916. All exposed leading edges and transverse joints shall be factory coated or coated with adhesive during fabrication.

C. Duct liner shall be additionally secured with mechanical fasteners, either weld-secured or impact-driven, which shall compress the duct liner sufficiently to hold it firmly in place. Adhesive bonded pins are not permitted due to long-term adhesive aging characteristics.

Spacing of mechanical fasteners with respect to duct liner interior width shall be in accordance with SMACNA HVAC DCS. Maximum spacing for mechanical fasteners shall be as follows:

Velocity = 0 to 2,500 feet per minute (0 to 12.8 m/s):

From transverse end of liner 3" (75mm)

Across width of duct 12" (300mm) O.C.

From corners of duct 4" (100mm)

Along length of duct 18" (450mm) O.C.

Velocity = 2,501 to 5,000 feet per minute

(12.8 to 25.4 m/s):

From transverse end of liner 3" (75mm)

Across width of duct 6" (150mm) O.C.

From corners of duct 4" (100mm)

Along length of duct 16" (400mm) O.C.

D. QuietR® Duct Liner products shall be cut to assure overlapped and compressed longitudinal corner joints.

E. Quiet R® Duct Liner board shall be cut to assure tight, over-lapped corner joints. The top pieces of liner board shall be supported at the edges by the side pieces.

3.03 INSPECTION

A. Upon completion of installation of duct liner and before operation is to commence, visually inspect the system and verify that the duct liner insulation has been correctly installed.

B. Open all system dampers and turn on fans to blow all scraps and other loose pieces of material out of the duct system. Allow for a means of removal of such material.

C. Check the duct system to ensure that there are no air leaks through joints.

3.04 SAFETY PRECAUTIONS

A. Contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats and eye protection.

B. The contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

END OF SECTION 230714

SECTION 230719 – PIPING 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 HVAC piping systems:

1. Heating hot-water piping.

1.3 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.

1.4 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.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, 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.

1.5 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.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

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 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. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
   1. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

C. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Block Insulation: ASTM C 552, Type I.
   2. Special-Shaped Insulation: ASTM C 552, Type III.
   3. Board Insulation: ASTM C 552, Type IV.
   4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
   6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, with factory-applied FSK jacket/FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

E. Mineral-Fiber, Preformed Pipe Insulation:

   1. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

F. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ/FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 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. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Phenolic and Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
2. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 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: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Adhesive: As recommended by jacket material manufacturer.
   2. Color: Color-code jackets based on system.
   3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:
   1. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
      a. Moisture Barrier for Indoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper/2.5-mil- (0.063-mm-) thick polysurlyn.
      b. Factory-Fabricated Fitting Covers:

         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-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.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches (75 mm).
   2. Thickness: 11.5 mils (0.29 mm).
   3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Width: 3 inches (75 mm).
   2. Thickness: 6.5 mils (0.16 mm).
   3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Width: 2 inches (50 mm).

2. Thickness: 6 mils (0.15 mm).
3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches (50 mm).
2. Thickness: 3.7 mils (0.093 mm).
3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.9 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with [wing seal] [or] [closed seal].
2. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy soft-annealed, galvanized 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.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: 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 (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade 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 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, 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. 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 application and finishing.

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 at attachment 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 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.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 (50 mm) o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to 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 more than 75 percent of its nominal thickness.

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 (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

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, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, 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 strainers 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. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. 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.
7. 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.
8. 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.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

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.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover

and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of 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 factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, 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 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 cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), 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. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

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 factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied 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 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 (25 mm), 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 not available, 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 not available, 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 (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) 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 (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) 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 PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

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:

1. Fire-suppression piping.
2. Drainage piping located in crawl spaces.
3. Below-grade piping.
4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Heating-Hot-Water Supply and Return, 200 Deg. F and below:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:

a. Mineral Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.

2. NPS 1-1/2 and Larger: Insulation shall be the following:

a. Mineral Fiber, Preformed Pipe, Type I: 2 inches thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

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. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 230719

SECTION 230900 – HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section details the requirements of the projects Building Management System (BMS), utilizing Direct Digital Controls (DDC) based control equipment for HVAC systems and components, including control components for units not supplied with factory provided controls.

1.2 RELATED SECTIONS

A. The Drawings and the provisions of the project including General, Supplementary, and Special Conditions, and Division 1 - General Requirements, apply to work specified in this section. The BMS contractor (BMSC) shall familiarize himself with the terms of the above documents and any sections hereinafter referred to that affect this work. If the BMSC believes there are conflicts or missing information in the project documents, the BMSC shall promptly request clarification and instruction from the A-E design team.

B. SECTIONS INCLUDE THE FOLLOWING:
1. “BMS Diagrammatic details”, as shown on the project drawings.
2. Division 26 Section “Common Work Results for Electrical”
3. Division 26 Section “Raceway and Boxes for Electrical Systems”
4. Division 26 Section “Low Voltage Electrical Power Conductors and Cables”
5. Division 26 Section “Wiring Devices”

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. RELATED SECTIONS INCLUDE THE FOLLOWING:
1. Division 1 Sections
2. Division 23 Section “Common Work Results for HVAC”

B. PRODUCTS NOT SUPPLIED, BUT INSTALLED UNDER THIS SECTION:
1. Unit Manufacturer field mounted sensors
2. Unit Manufacturer network communications wiring

1.4 BUILDING MANAGEMENT SYSTEM DESCRIPTION (BASIS OF DESIGN HONEYWELL)

A. OVERVIEW: This section contains the design intent and functionality of the BMS. The BMSC shall provide a direct extension of the Honeywell Niagara 4 Platform based Building Management System Utilizing Direct Digital Control (DDC), for the heating and cooling air conditioning systems and shall interface with other building microprocessor based subsystems as shown on the project documents, points lists, drawings and as described in these specifications. This scope of work shall include a complete and working system including all engineering, programming, controls and installation materials, installation labor, commissioning and start-up, training, final project documentation and warranty.

B. PROJECT DRAWINGS AND SPECIFICATIONS: The work of the single BMSC shall be as defined individually and collectively in all Sections of this Division’s specifications together with

the associated project drawings and the associated interfacing work as referenced in the related documents. The project BMS diagrams and drawings are diagrammatic only and shall not be utilized for installation configuration or mounting.

C. BMS DESIGN SCOPE INTENT: The intent of this specification Section is to provide the following features, functionality, and interface services.

D. SCOPE OF WORK: Furnish all labor, materials, and equipment necessary for a complete and operating extension of the Honeywell Building Management System, utilizing Niagara 4 Direct Digital Controls as shown on the drawings and as described herein. The projects control diagrams and drawings are diagrammatic only and are provided to show overall design intent. All DDC controllers furnished in this section shall communicate on a peer-to-peer bus over an open protocol bus (Examples: LonTalk, BACnet, Modbus). The intent of this specification is to provide a system that is consistent with BMS systems throughout the owner's facilities running the Niagara4 Framework.

E. BMS SUPERVISORY NETWORK CONTROLLER OPEN PROTOCOLS: The BMS 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. An Open System architecture shall provide secure Web access using MS Internet Explorer from any computer on the owner's LAN. Each Supervisory Network Controller and DDC controller shall be peer-to-peer BACnet™ Open Systems protocol communication and shall communicate via the district's Wide Area Network (WAN) using BACnet™ open protocol.

F. NO PROPRIETARY PROTOCOLS: Existing proprietary networks or system that are not as specified may be required to be integrated to the BMS or replaced entirely. Expansion of these proprietary protocols shall not be acceptable. Examples of unacceptable proprietary communication networks are (but not limited to) Johnson N2, Siemens Apogee, Alerton IBEX, Carrier Comfort Network, Trane Comm 4, Trane Comm 3, Honeywell C-Bus, Arcnet, etc.

G. DATA ANALYTICS: The Building Management System Contractor (BMSC) shall expand the Honeywell Forge System Real-Time Active Building Management System Dashboard and Analytic Display.

H. OCCUPIED SPACES: All work in occupied spaces or which adversely affect occupants shall be performed during coordinated with the Facilities Department to occur during unoccupied times, or after-hours at no additional cost.

I. EMBEDDED PROGRAMMING TOOLSET: All control devices furnished with this Section shall be programmable directly from the Niagara 4 Workbench. The use of configurable or programmable controllers that require additional software tools for post-installation maintenance shall not be acceptable.

J. INSTALLATION: The Building Management System shall be complete in all respects including labor, materials, equipment, and services necessary, and shall be installed by personnel regularly employed by the Building Management System Contractor (BMSC). The Building Management System Contractor shall utilize Union electrician labor for all the system installation.

K. GRAPHICS: All graphics and navigation schemes for this project shall meet the standard of the Honeywell Niagara4 Framework server. Include all extension of software licensures and software maintenance which is required to modify the existing BMS programs and graphics.

L. FULL CLEARENCE AND SYSTEM ACCESS: The Owner shall receive Administrator level login and passwords for at first training session. The Owner shall have full licensing and full access

rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS. All of the BMS I/O points along with their associated control parameters, calculations and variables shall be accessible via any Web Browser through a secured connection to the BMS.

M. OPEN SOURCE: The BMS shall Open Source, consisting of materials and components which are available through Open Source product procurement suppliers. Single source exclusivity or other conditions which inhibit the Owner from obtaining both materials and support services from less than three independent procurement avenues of shall not be acceptable. The BMSC shall at the request of the A-E provide the Open Source names, addresses and contact information of at three (3) additional independent sources of acquiring the BMS products.

N. NIAGARA OPEN SYSTEM PLATFORM (BACnet): Only a BMS that utilizes the Niagara 4 Framework shall satisfy the requirements of this section. Any BMSC that requires additional server software shall be unacceptable. The BMSC shall furnish and install a complete Honeywell Niagara N4 Frameworks BMS including all necessary hardware, all operating and applications software necessary to perform the control sequences as called for in Section 230900 “Sequence of Operation for HVAC Equipment”, BMS Diagrammatic Details, as shown on the project drawings. The new DDC controllers furnished in this section shall be an Open System platform. All programming shall utilize the Open Niagara N4 Platform embedded software package and communicate peer-to-peer via the BACnet communications protocol.

O. NIAGARA INTERFACE CONFORMANCE STATEMENTS (NICS): All NICS shall follow the Open Niagara Interface Conformance specifications. All JACE hardware licenses and certificates shall be stored on local MicroSD memory card employing encrypted “safe boot” technology. To ensure quality, any additional JACE hardware products used on this project shall come through the Tridium Richmond, VA shipping facility. JACE hardware products not meeting these requirements shall not be allowed.

P. PEER TO PEER COMMUNICATIONS: The BMS architecture shall fully support a multi-vendor environment and be able to integrate third party systems via existing vendor protocols including, as a minimum, BACnet. protocol

Q. WEB-BASED GRAPHICAL USER INTERFACE: The Operator shall be able manage the BMS through a connected web-browser software without additional applets or software required from an open web-browser. The BMSC shall provide 3-Dimensional web-based color and animated graphics. The graphics shall include floor plans showing the location of the controlled equipment and links to the individual equipment graphics. Copies of the web graphics shall be retained in the BMS Archival Data Server.

R. LOCAL AND REMOTE CONNECTIVITY: The BMS shall provide the Owner with a secure remote and local access shall be through an internal TCP/IP network connection. Alarm notification to designated stations and personnel through the TCP/IP network connection.

S. INFORMATION TECHNOLOGY (IT) COMPLIANCE: The BMS shall be designed for use with the Owner’s current enterprise level IT system. The BMS TCP/IP devices located in IT rooms shall be fully IT compatible devices that communicate directly on the IT infrastructure in the facility.

T. APPLICATION SPECIFIC CONTROLLERS (B-ASC): B-ASC Controllers shall communicate across a floor level MS/TP communications network.

U. BUILDING MANAGEMENT SYSTEM DESIGN: The BMS design shall be by the BMSC’s in-house engineers.

V. STANDARD COMPONENTS: All material and equipment shall be standard components, regularly manufactured for this and/or other systems and not custom designed specifically for this project. All devices and components shall have been thoroughly tested and proven in actual use for at least two years prior to this project.

W. SCALABILITY: The system shall be scalable in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, and operator interface devices.

X. SINGLE FAULT INDEPENDENCE: The network riser architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC controller shall operate independently by performing its own specified control, alarm management, operator I/O, and data collection. The failure of any single component or network connection shall not interrupt the execution of any control strategy, reporting, alarming, and trending function, or any function at any operator interface device.

Y. PEER-TO-PEER: DDC Controllers shall be able to access any data from, or send to control commands and alarm reports to, any other DDC Controller or combination of DDC controllers on the network without dependence upon a central or intermediate processing device.

Z. ALARMS: DDC Controllers shall also be able to send alarm reports to multiple operator workstations without dependence upon a central or intermediate processing device.

AA. SECURITY: DDC Controllers shall be able to assign password access and control priorities to each point individually. The Logon password shall enable the operator to monitor, adjust or control only the points that the operator is authorized. All other points shall not be displayed at the PC workstation or portable terminal. Passwords and priority levels for every point shall be fully programmable and adjustable.

BB. SPARE CAPACITY: All DDC controllers shall be installed with 20% spare I/O points of each type (minimum 1) and a 50% spare memory capacity.

CC. BUILDING MANAGEMENT SYSTEM CONTRACTOR (BMSC)'S RESPONSIBILITY:

1. The Building Management System Contractor (BMSC) shall only use inhouse employees who are skilled, experienced, factory trained, and familiar with the specific equipment, software, standards, and configurations to be provided for this Project.
2. The BMSC shall provide a complete, neat, and workmanlike installation using only directly employed who are skilled, experienced, trained, and familiar with the specific equipment, software, standards, and configurations to be provided for this Project.
3. The BMSC shall manage and coordinate the BMS work in a timely manner in consideration of the Project schedules and shall coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.
4. The BMSC shall provision all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in this section which are required for the complete, fully functional BMS.

DD. CONTINUATION OF EXISTING WARRANTIES AND SERVICES: The BMSC shall ensure all labor and installations performed do not void any existing warranties or services. If such a condition does occur, the BMSC shall be fully responsible for providing for and remedying the condition to the satisfaction of the owner.

1.5 COORDINATION AND WORK RESPONSIBILITY AND MATRIX

A. TRADE RESPONSIBILITIES MATRIX: The demarcation of work and responsibilities between the BMSC and other related trades shall be as outlined in the "Coordination and Work Responsibility Matrix" below:

Coordination and Work Responsibility Matrix Work Description	Furnish	Install	Low Voltage Wiring	Line or Power Wiring
BMS N4 DDC Controllers	BMSC	BMSC	BMSC	-
BMS control wiring	BMSC	BMSC	BMSC	BMSC
BMS power wiring	BMSC	BMSC	BMSC	26
BMS communications wiring	BMSC	BMSC	BMSC	-
Air Handling Unit controls	BMSC	BMSC	BMSC	26
Fan-Powered Box controls	BMSC	BMSC	BMSC	26
Control Panels (Wall)	BMSC	BMSC	BMSC	26*
*Reference Equipment Unit Schedule and specification, BMS Diagrams and Specification Section 230900. Responsibility or work is additionally specified under separate subsections.				
DIV23	Division 23 Mechanical Contractor			
DIV26	Division 26 Electrical Contractor			
BMSC	Division 23 Building Management System Contractor			
UM	Equipment Unit Manufacturer			

B. BMSC ELECTRICAL WORK: The BMSC shall provide electrical work as required in the specification, including:
1. Installation of all control wiring by a New York licensed Electrical Contractor.
2. All BMS electrical work, except as otherwise specified, or shown on the Division 26 Electrical specifications or drawings.
3. Installation of control wiring may include line voltage and low voltage wiring, as required.
4. Power wiring (120VAC) for the BMS, including control panels, DDC controllers, actuators, and sensors from a designated circuit furnished by the Division 26 Electrical Contractor.
5. All control wiring in mechanical equipment spaces shall be installed in EMT. The conduit for power systems may be used for running control line voltage wiring. Low voltage plenum rated wiring can be run exposed above accessible ceiling and shall be supported per code and not laid on ceiling tile grid.
6. Low voltage wiring shall be concealed in finished rooms. If any wiring must be exposed in rooms, it shall be installed in wiremold raceway.
7. A monitoring point from the smoke detectors to the DDC controller for status. Where multiple detectors are provided, one signal shall be provided.
8. All safety devices wiring through the Hand and Auto positions of motor starting devices.

C. DIVISION 26 ELECTRICAL WORK (DIV26): The Division 26 Electrical Contractor Work shall be responsible for all interlock and wiring on the Division 26 Electrical specifications or drawings. The Division 26 Electrical Contractor shall coordination with the BMSC for any required field control panel circuit feeds. The Division 26 Electrical Contractor, as part of his contract, shall provide 1P-20A circuit breakers. The Division 26 Electrical Contractor shall also provide power wiring to motors, heat trace, junction boxes for power to BMS panels and all work related to smoke detectors, smoke dampers, and the fire alarm system.

D. DIVISION 23 MECHANICAL WORK (DIV23) The Division 23 Mechanical Contractor (MC) shall be responsible for the Installation of automatic control valves, threadolet, thermowells, flow meters/switches, pressure sensor taps and associated shut-off/bypass cocks or any other devices required in the piping. Any Motor starters furnished by the Mechanical Contractor shall have control transformers and one set of auxiliary contacts, as required for interlocks.

1.6 PROJECT SITE CONDITIONS:

A. COOPERATION WITH OTHER TRADES: Coordinate the Work of this section with that of other sections to ensure that the Work shall be carried out in an orderly fashion. It shall be the BMSC's responsibility to check the Project and Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct, and conduit runs, electrical outlets and fixtures, air diffusers and structural and architectural features. The BMSC shall repair any damage caused by his work to the building(s) and equipment at no additional cost to the owner.

B. PROJECT SEQUENCING: Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

C. COMPONENT INSTALLATION: Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

D. CHANGES IN SCOPE OF WORK: Any changes in the scope of work must be authorized by a written Change Order, and issued by the customer, in accordance with Contract conditions.

E. CORRECTION OF WORK: The BMSC shall promptly correct all BMS work found to be defective or failing to conform to the Contract Documents at no additional cost.

1.7 PERFORMANCE STANDARDS

A. STANDARD MATERIAL/PRODUCTS: All material and equipment used shall be standard components, regularly manufactured and available, and not custom designed especially for this project

B. MODULAR DESIGN: The system architecture shall be fully modular permitting expansion of application software, system peripherals, and field hardware.

C. PERFORMANCE: The system, upon completion of the installation and prior to acceptance of the project, shall perform all operating functions as detailed in this specification.

D. SINGLE SYSTEM ARCHITECTURE: The BMS shall be consistent with BMS system throughout the owner's facilities running the Niagara 4 Framework. The BMS shall fully integrate the unit manufacturer HVAC controls systems into a new Open Source - Open System Niagara Frameworks BMS. The BMS shall fully integrate any remaining legacy DDC controls systems into a new Open Source - Open System Niagara Frameworks BMS. All BMS DDC controllers shall be available through avenues for procurement and from multiple sources (Open Source).

E. OPEN SYSTEM: OPEN PROTOCOL BMS COMMUNICATIONS: The entire BMS shall be in compliance with the BACnet standard. BACnet protocols and LAN types shall be used throughout and exclusively. Non-BACnet compliant or propriety equipment or systems (including gateways) shall not be acceptable and are specifically prohibited. As part of BMS submittal package the BMSC shall provide Product Information Conformance (PIC) statement for each Niagara N4 DDC Controller, indicating the DDC controller’s Niagara and BACnet standard. The BMS shall conform to the industry network standards utilizing TCP/IP connections. The Building Management System product-lines, which are based on a proprietary operating system, utilizing proprietary networks, baud-rates or variants which cannot be extended by third party DDC System manufacturers, will not be acceptable.

F. OPEN SOURCE: WEB BASED DIRECT DIGITAL CONTROLS: The BMS shall consist of Open Source BACnet Direct Digital Controllers (DDC). All of the BACnet DDC controllers shall be integrated into a distributed network system communicating over a single communications network. All web graphics shall be generated for interface with a standard web browser. The Operator shall interface with the BMS from any standard browser over a TCP/IP connection, including over the Internet. All programming and system software shall be licensed to the Owner with full password capability and access. Under no circumstances shall any part of the BMS or software be licensed or controlled by the BMSC. Upon completion of the project, the BMSC shall provide to the Owner the entire programming software including original installation discs.

G. WEB BASED 3-DIMENSIONAL COLOR GRAPHICS: Utilize and Extend the existing Niagara 4 Platform Graphical User Interface. The BMS shall be tested using manufacturer's recommended hardware and software for Operator Workstation (Web Server and web browser). All Web Based Graphics shall be generated on the workstation for use over the Web. The web browser shall depict the equipment's animated graphics, scheduler graphics, alarm screens, point and click setpoint adjustments, point and click alarm acknowledgements and resets and other graphics displays required by the Operator. The BMS System architecture shall provide secure Web access using any of the current versions of web browsers from any computer on the Owner's LAN. BMS connected equipment to be monitored, controlled, and scheduled from web client computers onsite and remote sites. The units shall be dynamically depicted in 3 dimension aspect, with animated components in real time. All BMS interface points shall be on standard PC web browsers that do not require any special software from the BMS manufacturer for use as a GUI.

H. WEB GRAPHIC DISPLAY: The Graphics screens may have up to 20 dynamic points with current data, display this data within 10 seconds. The Graphic screens shall automatically refresh every 15 seconds.

I. PROGRAM EXECUTION FREQUENCY: The DDC controllers shall be able to completely execute PID loops at a frequency down to once per second, consistent with the mechanical process under control.

J. RESPONSE TIMES:
1. OBJECT SCANNING: Transmit change of values to requesting device within six seconds.
2. OBJECT COMMAND: Device response of less than two seconds after command.
3. ALARM RESPONSE TIME. Annunciation at the workstation within 15 seconds.
4. RESTORATION OF POWER: Restart of DDC controllers within 180 seconds.
5. CONFIGURATION AND TUNING SCREENS: Automatically refresh within 6 seconds.

1.8 SUBMITTALS

A. INDEX OF SUBMITTALS: Submit under provisions of Section 01 33 23 Shop Drawings, Product Data, and Samples. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description. The submittal packages shall be as approved and reviewed by the Architect and Engineer (A-E) for contract compliance.
1. Contractor Qualification Submittal
2. BMS Software and Hardware Submittals
3. Graphics Submittal
4. Operation & Maintenance Manual Submittal

B. SUBMISSION: Submittals shall be in defined packages. Each submittal package shall be complete and shall only reference itself and previously submitted packages. Provide drawings

as AutoCAD compatible files on optical disk (file format: .dwg, .dxf, .vsd, or comparable) or hard copies on 11” x 17” prints of each drawing.

C. SUBMISSION PERIOD: The BMSC shall submit a list of projected dates of required submittals within thirty (30) days of contract award.

D. SUBMITTAL QUANTITY: The BMSC shall submit Electronic copies (PDF) of shop drawings of the entire control system shall be submitted with two (2) hardcopies of each submittal type submitted for review prior to ordering or fabrication of the equipment.

E. DEVIATIONS: Any deviations from these specifications or the work indicated on the drawings shall be clearly identified in the Submittals.

F. SUBMITTAL REVIEW PERIOD: Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BMS design work.

G. SUBMITTAL APPROVAL: Submittals shall be approved before any equipment is installed. Begin no work until submittals have been approved for conformity with design intent.

H. CORRECTION – RESUBMISSION: The BMSC shall correct any errors or omissions noted in the first A-E review, and provide a resubmission for approval, showing corrections prior to installation. Any further subsequent resubmissions for errors or corrections previously noted shall be at the expense of the BMSC.

I. CONTRACTOR QUALIFICATION SUBMITTAL: Submit documentation of BMS Manufacturers and BMSC’s qualifications, including those indicated in this Section’s "Quality Assurance" if so, requested by the A-E.

J. ACTION SUBMITTALS: When manufacturer’s cutsheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements.

K. CONTROL DIAGRAMS: BMS network architecture diagrams: Riser diagrams showing network switch locations, network topology including control network layout, communication protocol, and wire types. Showing including all nodes and interconnections. Schematic diagrams of all control, communication, and power wiring for central system installation. Show interface wiring to control system.

L. SEQUENCE OF OPERATIONS: Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system.

M. SYSTEMS SCHEMATICS: Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic use the same name.

N. BMS LEGEND: Provide a list of BMS point naming convention. Indicate the format, structure, and standards of typical point names. Each Field Tag shall be 6-10 characters in length and incorporate industry standard designations. The project plan designation of the equipment &/or room will be utilized. The naming convention shall follow the “BUILDING.FLOOR.ROOM.EQUIPMENT.POINT” format. Such that the specific point for the Supply Air Temperature on AHU 1 on the 3rd floor of Building A3 would be addressed as A3.FLR03.AHU01.SAT. Where a VAV in Room C313 would to be named “FLR3.AHU04.VAV.C313:Room Temp”

O. POINT SCHEDULES: Points schedule for each point in the ATC, including Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.

P. USER INTERFACE GRAPHICS: Provide samples of the graphic display screen types and associated menus. Provide a sample graphic of each controlled system with labeled control points and graphically show locations of control elements. Provide floor plan schematic diagrams indicating control panel and space temperature sensor locations. Provide the sample color graphics on 11 x 17" prints for each typical system indicating conceptual layout of pictures and data for each graphic. List of color graphics to be provided showing or explaining which other graphics can be directly accessed.

Q. BILL OF MATERIALS: Provide a complete bill of material indicating quantity, manufacturer, model number, and relevant technical data of equipment used. Show the manufacturer's description, technical data such as product specifications for relevant items furnished under this contract. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.

R. PRODUCT DATA SHEETS: Provide data sheets or marked catalog pages including part number, photo and description for all products including software. Show manufacturer's description and technical data, such as product specification sheets, installation, and maintenance instructions for items. Provide construction details, material descriptions, dimensions of individual components and profiles, and finishes. Provide Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity. Show Product description with complete technical data, performance curves, product specification sheets, installation, operation, and maintenance instructions including factors effecting performance.

S. MULTIPLE SUBMISSIONS: If multiple submissions are required to execute work within schedule, first submit a coordinated schedule clearly defining intent of multiple submissions. Include a proposed date of each submission with a detailed description of submittal content to be included in each submission. Clearly identify each submittal requirement indicated and in which submission the information shall be provided. Include an updated schedule in each subsequent submission with changes highlighted to easily track the changes made to previous submitted schedule.

T. HARDWARE SUBMITTAL: Shop Drawings shall include and consist of a complete list of equipment and materials, including manufacturers' catalog data sheets and installation instructions. Submit in printed and electronic format. Examples of written Unit Controller Checkout Sheets and Performance Verification Procedures for applications similar in scope shall be included for approval. Shop Drawings shall include the following requirements:

1. Prepare an index sheet of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
2. Prepare all shop drawings in the latest version of AutoCAD Software. The BMSC shall furnish an electronic copy with the submittal.
3. The BMS Riser Diagrams shall depict the locations of all controllers and workstations, with associated network wiring.
4. System Schematics of each mechanical system shall show all connected input/output control points, controllers, power supplies, system diagram, end device details,

termination points and wire and type required from control panel to end device with reference to their associated controller.
   a. Typical drawings shall be allowed where appropriate.
5. Shop drawings shall also contain complete wiring and schematic diagrams, sequences of operation, control system bus layout and any other details required to demonstrate that the system has been coordinated and shall properly function as a system.
6. Shop drawings shall Specific Terminal identification for all control wiring shall be shown on the shop drawings (i.e., point to point diagram).

U. PRODUCT DATA: Manufacturer's data sheets on each product to be used. Data shall contain manufacturer's data on all hardware and software products required by the specification including:
1. NICs for each BMS controller
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.
5. Product Certificates: Compliance with Article, Quality Assurance.

V. LOCAL APPROVAL: Control devices and specific BMS which require approval of the local authorities having jurisdiction shall comply with such regulations. The BMS shall obtain approval of such prior to installation. Where filing is necessary, the expense shall be borne by the BMSC. Provide a copy of all related correspondence and permits/approvals to the Owner and A-E.

W. ASBUILT DRAWINGS: Any revisions made during the installation, start-up, or acceptance portion of the project, shall be accurately reflected in the "as-builts". All BMS drawings shall be reviewed after the final system checkout and updated or corrected to provide 'Asbuilt' drawings to show exact BMS installation. All shop drawings shall be acknowledged in writing by the owner before installation is started and again after the final checkout of the system. The BMS installation shall not be considered completed until the 'asbuilt' drawings have received their final approval.

X. OPERATION AND MAINTENANCE (O&M) MANUAL: Upon completion of the work of this Section, six (6) Hard and Two (2) Electronic copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative. The O&M manual electronic media shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.
1. POINT OF CONTACT: The O&M manual shall contain the names, address and 24 hour telephone numbers of the BMSC and service representative.
2. GUI SECTION: This section of the O&M Manual shall contain Step by step procedures for each operator function, including login, Creating, modifying, or deleting schedules, Uploading/Downloading to the field hardware, Creating historical trends, collecting trend data, and generating trend graphs, Enabling/Assigning alarms, and messages to reporting actions/groups, Report generation and ‘third party software’ and Backing up software and data files. All Color Printout of graphic screens shall be included.
3. BMS CONTROL DIAGRAMS: This section shall contain the BMS architecture overview and networking configuration, equipment controllers and diagrams, and the BMS software and hardware cut-sheets with product descriptions.
4. HARDWARE: Installation, mounting and connection details for all field hardware and accessories
5. COMMISSIONING: This section shall contain Commissioning, setup, and backup procedures for all control modules/accessories, BMS server software, and database. Provide the final testing and commissioning reports along with the device checklists.

6. MESSAGES AND ALARMS: This section shall contain a Listing of basic terminology, alarms/messages, error messages and frequently used commands or shortcuts. All alarm messages for equipment and operator action required.
7. SOFTWARE: This section shall contain System Software Documentation of all Graphical Language Programs, detailing their application to specific HVAC equipment, together library detailing the function. It shall include the Graphical relationship of the projects mechanical equipment hierarchy.
    1) Software Operating manuals.
    2) Control Device address lists
    3) Color Printout of software applications
    4) All Software licenses.
8. SYSTEM MAINTENANCE REQUIREMENTS: This section shall contain Maintenance instructions, recommended preventive maintenance procedures for all system components including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions. Provide a lists of spare parts for each type of control device, interconnection wiring diagrams with identified system components and devices. Provide the Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances. Include Calibration records and list of set points.
9. LICENSE AND WARRANTY: This section shall contain all BMS Licenses, Guarantee, and Warranty documents for all equipment and systems.
10. NOTICE OF COMPLETION: This section shall contain a document stating the date when the BMS is accepted for beneficial use and placed under warranty. At this time, the consultant shall issue a “notice of completion” and the warranty period shall start.
11. PRODUCT CERTIFICATES: Data Communications Protocol Certificates: Certifying that each proposed DDC system component complies with ASHRAE 135. Data Communications Protocol Certificates: Certifying that each proposed DDC system component complies with LonWorks.

1.9 QUALITY ASSURANCE

A. SINGLE POINT OF RESPONSIBILITY OF SYSTEM PERFORMANCE: A single BMSC shall be responsible for the complete installation and proper operation of the BMS. This BMSC shall exclusively be in the regular and customary business of designing, installing, and servicing computerized BMSs, similar in size and complexity to the BMS specified.

B. BMSC CLASSIFICATION RATING: The Building Management System Contractor must be qualified by the State of New York, C047 Electrical and C098 Energy Management Systems. The Division 23 Mechanical contractor’s qualifications shall not be acceptable. This requirement ensures that the Owner will contract with a BMSC that has good financial standing, experience, capacity, and necessary resources to install, maintain and provide future service to the installed Building Management System. A copy of this certification shall be part of the bid and/or submitted upon request by the owner or their representatives.

C. FACTORY AUTHORIZED REPRESENTATIVE: The BMSC shall be an either the local BMS manufacturer branch or shall be the BMS manufacturers Authorized representative. The BMSC shall be a fully certified, factory authorized & licensed representative for the BMS manufacturer and shall have maintained the highest recognition of certification of quality installations available (ACI-Direct) for a minimum of 5 years.

D. CAPACITY: The BMSC shall have fully trained and N4 system certified technicians on staff. Subcontracted personnel shall not be acceptable.

E. EXPERIENCE, COMPLEXITY, LONGEVITY AND PROJECT MAGNITUDE: The BMSC shall be responsible for the complete installation and proper operation of the control system. The

BMSC shall exclusively be in the regular and customary business of design, installation, and service of computerized BMS(s) similar in size and complexity to the system specified. As evidence and assurance of the BMSC's ability to successfully support the installation, the BMSC must have fully completed at least ten (10) projects utilizing the specified BMS, at least twice the value of this contract in each of the preceding five (5) years. A list of projects of comparable scope, detailing BMS complexity, communications, integrations comparable to this project shall be provided to the A-E upon request.

F. CONTROL SYSTEM EXPERTISE: The BMSC's primary business shall be regularly engage in the engineering, programming, installation, and service of total integrated BMS(s). The BMSC's business shall dedicated solely to the design and installation of Automation Temperature Controls & Building Management Systems. BMSC whose discipline do not concentrate solely to these categories shall not be acceptable.

G. LOCALITY: The BMSC shall have an established office staffed within a 50 mile radius of the project location. This office shall be staffed with a control engineers, project managers and fully trained and N4 system certified technicians. Subcontracted personnel shall not be acceptable.

H. EMERGENCY SUPPORT: The BMSC shall have an established 24 hour Emergency service organization and shall provide a 24 hour Emergency contact information to the Owner at time of acceptance. This point of contact shall be a "live" person, voice mail shall not be acceptable.

I. READY STOCK SPARE AND REPAIR PARTS AVAILABILITY: The BMSC shall maintain and have an independently verifiable on hand inventory of ready stock and repair spare parts inventory, Direct Digital Controllers, and electronic service parts, including all testing and diagnostic equipment necessary to support this work.

J. SPECIFIC PROJECT REQUIREMENTS: In the submittal, the contractor shall indicate Full Conformance and Compliance to the following requirements:
   1. No Proprietary communications protocol at any level.
   2. The database must be a standard Niagara Open Database.
   3. All systems must communicate over the Wide Area Network (WAN).
   4. All system graphics shall utilize Niagara Web-based 3-D structure.
   5. All new BACnet DDC controllers must communicate over the existing Honeywell (WEBs) Communication Network and use the Niagara N4 Framework for the owner interface into the BMS.

1.10 PROJECT MANAGEMENT

A. PRE-INSTALLATION COORDINATION MEETINGS: A meeting shall convene a minimum two weeks prior to starting work of this section. Reference Section 01 31 00 – Project Management and Coordination: Pre-installation meeting.

B. SYSTEM INSTALLATION OVERSITE: The BMSC shall designate an experienced BMS Project Manager (PM) who shall provide project management of the BMS installation and commissioning. The designated PM shall be empowered to make technical, scheduling and field related decisions on behalf of the BMSC. As a minimum, the PM shall manage the scheduling of the work to ensure that adequate materials, labor, and other resources are available as needed. Manage the financial aspects of the BMS Contract. Provide coordination as necessary with other trades. Be responsible for the work and actions of the BMS workforce on site.

C. WORKPLACE SAFETY PROGRAM: The BMSC shall provide a safety program in compliance with the Contract Documents. The BMSC shall have a corporately certified comprehensive

Safety Certification Manual and a designated Safety Supervisor for the Project. The BMSC and its employees and sub trades comply with federal, state, and local safety regulations. The BMSC shall ensure that all sub-contractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA having jurisdiction for at least each topic listed in the Safety Certification Manual. The BMSC shall sign and date a safety certification form prior to any work being performed, stating that the BMSCs' and subcontractors company are in full compliance with the Project safety requirements.

D. PERMITTING: The BMS requiring approval of local authorities shall comply with such regulations shall be approved by such prior to installation. Where filing is necessary, unless stated otherwise in the project documentations, the expense shall be by the BMSC. Provide a copy of all related correspondence and permits/approvals to the Owner.

1.11 MATERIAL DELIVERY, HANDLING, AND STORAGE

A. DELIVERY AND HANDLING: The integrity of shipping cartons for each piece of equipment and control device through shipping, storage and handling shall be maintained to prevent equipment damage. Store equipment and materials inside and protected from weather.

B. INSPECTION: Accept controls on-Site in original factory packaging and inspect for damage.

C. STORAGE: Any onsite equipment and materials shall be stored inside and protected from weather.

1.12 WARRANTY - MATERIAL AND LABOR

A. WARRANTY PERIOD: Labor and materials for control systems shall be warranted for a period as specified under Warranty in 017839 Project Record Documents. Provide a one year labor and material warranty on the BMS. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship, or materials, it shall be replaced, repaired, or adjusted at the option of the BMSC at the cost of the BMSC. The BMSC shall maintain an adequate supply of repair devices within 50 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMSC's normal business hours.

B. START OF WARRANTY DATE: After the Engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, the Engineer shall certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. The BMSC shall provide the owner in writing the Date of acceptance and the beginning of the warranty period.

C. SOFTWARE WARRANTY: The BMSC shall provide updates to operator workstation software, project-specific software, graphic software, database software, and firmware that resolve identified software deficiencies at no charge during warranty period. Do not install updates or upgrades without Owner's written authorization.

D. WARRANTY - REMOTE SERVICE SUPPORT: As part of the warranty response, the BMSC shall be required to remotely connect to the facility's BMS during the warranty period. This remote connection to the facility shall be within two (2) hours of the time that the problem is reported to the BMSC. This coverage shall include normal or after business hours, weekends, and holidays. If the problem cannot be resolved with remote support services, the BMSC shall dispatch the qualified personnel to the project site to resolve the problem within 24 hours.

1.13 OWNERSHIP OF PROJECT MATERIAL

A. PROGRAMMING AND SOFTWARE: The Owner shall have full ownership and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS. Project specific software and documentation shall become Owner's property.

PART 2 - PRODUCTS

2.1 BUILDING MANAGEMENT SYSTEM MANUFACTURERS

A. MATERIAL SAMPLES: Due to the unique nature of the project, all equipment for this building will be special, minimal size, and with special colors. All components for the project will require samples as part of the approval process.

B. ACCEPTABLE MANUFACTURERS: The BMS architecture shall consist of the products of a manufacturer regularly engaged in the production of DDC Control Systems and shall be the BMS manufacturer's latest standard of design at the time of bid. All controls, other than relays, transformers and panels shall be the product of the same manufacturer. The basis of design for the BMS is the Niagara Platform as manufactured by Honeywell Controls (WEBs-N4) as provided by an ACI-DIRECT. Regional ACI-Direct AME, Inc. (973) 884-4100 Email: info@ame-inc.com; Website: http://www.ame-inc.com).

C. Jonson Controls

D. Schneider Electric Controls

E. Siemens Controls

F. Or Equal Approved

G. ADHERENCE: Listing as an approved BMS manufacturer does not relieve the BMSC from meeting all aspects and requirements of this specification.

H. NON-COMPLIANT AND UNACCEPTABLE SYSTEMS: Any BMS provided by single sourced, or equipment manufacturer provided control systems (e.g., York, Carrier, Daikin, Trane, etc...), any of the approved BMS manufacturers which utilize proprietary controls, Non-Open Source or Not-Open Systems or requests which have not received the Engineers written approval as detailed in Part 1 of this section shall not be acceptable. Wireless networks shall not be acceptable.

2.2 SYSTEM DESCRIPTION

A. OVERVIEW: The BMS specified in this document shall be Web-based, utilizing the Open Source – Open System Niagara Platform. The Building Management System (BMS) shall be comprised of interoperable B-ASC DDC Controllers, customized 3-D graphics and graphical process programming direct digital controllers, software, and other control devices for a complete BMS as specified herein. The BMS shall use a Niagara N4 Platform architecture and shall integrate a wide variety of third-party devices and applications. UM's DDC devices shall be integrated to the N4 Platform through a common protocol. Equipment graphics shall be generated and included on the Web-based Graphical User Interface.

B. SPECIFIC PROJECT REQUIREMENTS:
   1. No Proprietary communications protocol at any level.
   2. All Hot Water valves shall fail open to the coil.
   3. All valve actuators shall have a mechanism for local manual override at the unit.
   4. All modulating control valves shall be 0-10VDC or 4-20mA.
   5. All System Equipment Graphics, including Floor plans shall be depicted in a 3-D aspect.
   6. All Graphical Floor plans shall be thermographic, changing color as deviation from setpoint.
   7. High Priority alarms, as defined by the owner, shall provide an escalation text or email.

C. ENVIRONMENTAL CONDITIONS FOR DEVICES: Products shall operate without performance degradation under ambient environmental temperature, pressure and humidity conditions encountered for installed location. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by product and application.

D. DDC SYSTEM RELIABILITY: Design, install and configure DDC controllers, gateways, routers to yield a MTBF of at least 20,000 hours, based on a confidence level of at least 90 %. MTBF value shall include any failure for any reason to any part of products indicated. If required to comply with MTBF indicated, include DDC system and product redundancy to maintain DCC system, and associated systems and equipment that are being controlled, operational and under automatic control. Critical systems and equipment that require a higher degree of DDC system redundancy than MTBF indicated shall be indicated on Drawings.

2.3 BUILDING MANAGEMENT SYSTEM NETWORK ARCHITECTURE

A. GENERAL: The extension of the BMS shall be comprised of a network of interoperable, standalone digital controllers, graphics and programming and other control devices for a complete system as specified herein. The BMS is based in the Honeywell (WEBs-N4) BACnet architecture. The BMS shall integrate a wide variety of third party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

2.4 OPEN, INTEGRATED, AND INTEROPERABLE.

A. OVERVIEW: The design intent is to provide an Open Source - Open BMS utilizing distributed web based direct digital controls which communicate over a BACnet communications network. The BMS's BACnet controllers, materials and components furnished shall be unrestricted and available for acquisition by the Owner through multiple independent sources and service providers. The contractor shall provide the sources and providers to the M-E-P, upon request.

B. NETWORK COMMUNICATIONS PROTOCOL: Network communication protocol(s) used throughout entire DDC system shall be open and available to other companies for use in making future modifications to DDC system. The Honeywell WEBs-N4 DDC Controllers shall reside on the BACnet communications sub-network.

C. HIERARCHICAL NETWORK TOPOLOGY: A hierarchical network topology is required to assure reasonable system response times and to manage the flow and sharing of data, without unduly burdening the owner's internal Intranet network.

D. PEER TO PEER DDC CONTROLLERS: All DDC controllers supplied under this contract shall be true "peer to peer" communicating devices. DDC controllers requiring "polling" by a host to pass data shall not be acceptable

E. OPEN GRAPHICAL OBJECTS: The BMS GPL software shall employ object oriented technology (OOT) for representation of all data and control devices within the system.

F. OPEN DATABASE CONNECTIVITY: An Open Database Connectivity (ODBC) or Structured Query Language (SQL) server database is required for all data storage. The BMS system shall incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary interface, programs, or browser plugins. Any BMS system which provides or requires a proprietary database or user interface program shall not be acceptable.

2.5 SUPERVISORY NETWORK BUILDING CONTROLLER (SNC)

A. Overview: The Supervisory Network Building Controller(s) (SNC) are designed to manage communications between itself and other peer-to-peer Supervisory Network Controllers (SNC) and with any BMS BACnet TCP/IP, SNMP and Niagara 4 Fox networked connected Operator workstations (OWS) that are part of the BMS. Additionally, the Supervisory Network Building Controller(s) (SNC) are to manage the communications between its communications sub-network Building Level controller(s) (B-BC), Advanced Application Controller(s) (B-AAC), and Application Specific Controller(s) (B-ASC). The SNC shall perform control and operating strategies for the various HVAC and integrated systems controlled utilizing information from any of the distributed DDC controllers connected to the BMS. The SNC shall be fully programmable to meet the unique requirements of the facility. The use of a proprietary communication protocol for peer to peer communications between SNC's shall not be acceptable.

B. Open Protocols (Standard): The SNC shall be provided with BACnet, LON, Modbus, N2, SNMP, KNx Open Communications protocols by default.

C. Embedded Software: The SNC shall have embedded "Setup Wizards" controller programming software

D. Standard Programs: 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 networked devices.

E. Hardware Features: The SNC shall provide the following hardware features as a minimum:
1. Ports: Two 10/100 Mbps Ethernet ports/ Two Isolated RS-485 ports with biasing switches.
2. One USB Flash Drive
3. Onboard Memory: 1 GB RAM / 4 GB Flash Total Storage / 2 GB User Storage
4. MicroSD Memory Card with Encrypted Safe Boot Technology
5. Wireless: Wi Fi (Client or WAP)
6. Expansion Bus: High Speed Field Bus Expansion
7. Operating Temperature: Minus 4 to 140 degrees F Ambient
8. Integrated 24 VAC/DC Power Supply

F. Connectivity: The SNC shall support standard Web browser access via the LAN/WAN network, supporting a minimum of 16 simultaneous users.

G. Alarming: The SNC shall provide alarm recognition, storage, routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers. The SNC shall be able to route any alarm condition to any defined user location whether connected to a local network, remote via cellular modem, or wide area network. Alarm generation shall be selectable for annunciation type and acknowledgement requirements. Alarms shall be annunciated in any of the following manners as defined by the user: The following shall be recorded by the SNC for each alarm (at a minimum):
   1. Time and date.
   2. Equipment (air handler #, access way, etc.).
   3. Acknowledge time, date, and user who issued acknowledgement.

H. Device Security: The SNC shall support the following security functions.
   1. Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
   2. Role Broadcast Access Control (RBAC) for managing user roles and permissions.
   3. Require users to use strong credentials.
   4. Data in Motion and Sensitive Data at Rest be encrypted.
   5. LDAP and Kerberos integration of access management.

I. Data Structures: The SNC shall support the following data modeling structures to utilize Search; Hierarchy; Template; and Permission functionality:
   1. Metadata: Descriptive tags to define the structure of properties.
   2. Tagging: Process to apply metadata to components
   3. Tag Dictionary

J. Data Templates: The SNC shall employ template functionality. Templates are a containerized set of configured data tags, graphics, histories, alarms... that are set to be deployed as a unit controlled upon manufacturer's controller and relationships. All lower level communicating controllers (PEC, AUC, AVAV, VFD…) shall have an associated template file for reuse on future project additions.

K. Software Support: The SNC shall be provided with a 5 Year Software Maintenance license. Labor to implement not included.

2.6 BACnet APPLICATION SPECIFIC CONTROLLER (B-ASC)

A. CONTROLLER APPLICATIONS: Application of the B-ASC controller include Unit Ventilators, Temperature, humidity, dispersed CO2, occupancy, and emergency control.

B. The Application Specific Controller (B-ASC) shall be designed specifically to allow for specific application with the capability for custom programming to control the BMS's equipment.

C. All B-ASC programming shall comply with standard application programmable and shall at all times maintain their certification. All control sequences within or programmed into the B-AAC shall be stored in non-volatile memory. Device dependent upon the presence of a battery for memory retainage shall not be acceptable.

D. MINIMUM HARDWARE FUNCTIONAL REQUIREMENTS: The B-ASC shall be capable of either integrating with other devices or standalone room level control operation. The B-ASC shall have an internal time clock with the ability to automatically revert from a master time clock on failure.

E. PROGRAMMING FUNCTIONAL REQUIREMENTS:

1. Minimum Programming Functional Requirements: The B-ASC shall not require any external configuration tool or programming tool. All configuration and programming tasks shall be accomplished and accessible from within the Niagara 4 environment. B-ASC s shall support at minimum the following control sequences:
   a. General purpose control loops, linear and non-linear
   b. Demand Limit Control strategies,
   c. Setpoint reset
   d. Adaptive intelligent recovery
   e. Time of Day Reset.
   f. Start/Stop/Status loops.
   g. Boolean Logic functions (i.e., If/Then/Else ladder logic)
   h. Math Function loops.
2. The B-ASC controller shall have standard and custom HVAC programs which shall be modifiable to provide the Division 23 Section “HVAC Equipment Sequence of Operations".
3. The B-ASC controller shall maintain the Native Graphical Programming Language and graphics, fully programmable and configurable from any Niagara N4 Framework™ platform, not requiring any external configuration or programming tool. The Native programming software and “Setup Wizard” shall be embedded within the controller.
4. The B-ASC controller shall allow downloads and uploads from any Niagara N4 Framework™ platform, including providing offline program simulation.
5. The B-ASC controller shall be part of a networked system or allow for standalone operation.
6. The B-ASC controller shall provide continuous Adaptive Integral Algorithm Control Loop tuning.
7. The B-ASC controller shall have a loop execution response time of 1 second.
8. The B-ASC controller shall have a software notifications, when connected to a network:
   a. Significant Event Notification
   b. System Periodic Update
   c. Detection of Network Failure.
9. The B-ASC controller shall provide for “user defined” Network Variables (NV) for customized configurations and naming using Niagara N4 Framework™.
10. The B-ASC controller shall support 240 Network Variables with a byte count of 31 per variable.
11. The B-ASC controller shall support 960 separate data values.

F. HARDWARE FUNCTIONAL REQUIREMENTS:

1. Control Processors: The B-ASC controller shall have two microprocessors, Host and Comm. The Host processor shall provide FLASH memory for HVAC application programming, with RAM memory for HVAC program execution and data storage. The FLASH memory shall be retained for a minimum of ten years, a battery for memory retainage shall not be acceptable. The Comm processor shall manage the network communications.
2. Environmental Ratings: The B-ASC controller shall be function within an operating environment of 32 to 122 degrees F and 5 to 95 percent relative humidity, non-condensing.
3. Approvals and Listings: The B-ASC controller shall have the following certifications, listings, and approvals:
   a. BACnet Application Specific Controller (B-ASC)
   b. FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
   c. UL916 (Open Energy Management Equipment) with plenum rating.
   d. CSA (LR95329-3) Listed
   e. Canadian Standard C108.8 (radiated emissions).
   f. European Consortium standards: EN 61000-6-1; 2001 EN 61000-6-3; 2001

4. Device Status Indication (Host): A visible LED shall provide indication of the internal program functional status.
    a. Controller - Operating normally.
    b. Controller - In process of program download.
    c. Controller - In manual mode, under control of software tool.
    d. Controller - Lost Configuration.
    e. Controller – Low or No power, possible damage
    f. Controller - Host Processor not operating.
5. Bus Status Indication (Comm): A visible LED shall provide indication of the B-ASC controller's communication status:
    a. Bootloader running - MS/TP communication is present.
    b. Bootloader running - MS/TP token is not present.
    c. Bootloader not running - Processor missing bootloader image.
    d. Communications - Processor is not running
6. Internal Real Time Clock (RTC): The B-ASC controller shall have an internal Real Time Clock (RTC). The RTC shall allow for stand-alone operation or reference if Network Master Time clock communication function is interrupted. The RTC shall provide 24 hours, 365 days, multi-year calendar, day of week, including automatic daylight savings, configured for start and stop dates scheduling. The RTC shall have a time accuracy of plus or minus 1 minute per month at 77 degrees F and shall maintain its settings upon a loss of device power for a minimum of 24 hours at 32 to 122 degrees F.
7. Housing: The housing shall be UL plenum rated, with panel of din rail mounting.
8. Terminal Connections: The B-ASC controller's wire connectors shall allow for quick disconnection of external wiring, without removing the wire from the connector. The wire connectors shall have color coded labels.
9. Field Wire connections: The B-ASC controller shall have Digital Inputs (DI), Digital Outputs (DO), Analog Outputs (AO), Universal Inputs (UI), Internal Velocity Pressure sensor, and damper actuator (optional), as required to meet the Sequence of operations.
    a. The Universal inputs (UI) shall be configurable as binary N.O./N.C. inputs, analog resistive inputs (0 to 10K or 20K ohm NTC), analog voltage inputs (0 to 10 VDC), or analog current inputs (4 to 20 mA).
    b. The Digital Inputs (DI) shall be configurable as N.O., N.C or 15 Hz pulse counters.
    c. The Analog outputs (AO) shall be configurable as 0 or 2 to 10 Vdc or as 4 to 20 mA.
    d. The Digital Outputs (DO) shall be configurable as N.O. or N.C. and rated to switch 30 Vac/Vdc at 500 mA, or Relay outputs, (RO) rated for 1 Amp.
10. Communications Field Bus: The B-ASC controller shall a two wire, polarity insensitive communication via bus which provides 18 Vdc power and communications between enabled devices
11. Onboard Power VDC Supply: The B-ASC controller shall have one (1) integral 20 VDC 75 mA power supply, plus or minus 10 percent for external sensors. If the controller lacks a comparable internal power supply, a fully isolated, enclosed, current limited and regulated UL listed DC power supply for each shall be provided.

2.7 SYSTEM INPUT SENSORS

A. GENERAL REQUIREMENTS: Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

B. TEMPERATURE SENSORS - DUCT MOUNTED PROBE (TS-D): Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair.
    1. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.

2. Duct Type Temperature sensor shall be 20K ohm thermistor temperature sensors with an accuracy of plus or minus ; 0.5 degrees F, moisture resistant for mounting into a duct.
3. Duct mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of minus 40 to 160 degrees F. Duct sensors shall be rigid or averaging as shown on the project BMS diagrams. Averaging sensors shall be a minimum of 5 feet in length. For all mixed air and preheat air applications, install bendable averaging duct sensors with a minimum 8 feet long sensor element
4. The operating range shall be as indicated with an accuracy of plus 1 percent over the full range. The output shall be compatible with the panel it serves.
5. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
6. Acceptable Manufacturers:
    a. Honeywell Controls
    b. Engineer approved equal

C. CURRENT SWITCHES (CS):
1. Current actuated switches shall be self-powered, solid state with an adjustable trip current.
2. The switches shall be selected by the BMSC to match the application and output requirements of the DDC system.
3. The current sensing switch shall be self-powered with solid state circuitry and a dry contact output.
4. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device.
5. It shall accept over current up to twice its trip point range.
6. Approved applications of current sensing switches include monitoring of run status for fans, pumps, and other miscellaneous motor loads.
7. The Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
8. Acceptable manufacturers:
    a. Honeywell
    b. Senva
    c. Veris Industries

D. DIFFERENTIAL PRESSURE TRANSMITTERS (DPT):
1. General Pressure Transmitter Requirements:
    a. Range: Selection to provide full coverage of the to the measured media range.
    b. Over Pressure protection: 100 percent pressure range
    c. Outputs: 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
    d. Housing: Rated for local environment, minimum NEMA-1.
    e. Reference Accuracy: plus, or minus 1 percent of full scale.
    f. Zero & span: .04 percent linearity, hysteresis, and repeatability.
    g. Accuracy Range: 20 to 1 ratio turndown.
    h. Thermal Effects: less than .033 degrees F over 40 to 100 degrees F.
    i. Static Pressure Effect: 0.5 percent fill scale.
    j. Features: Non-interactive zero and span adjustments adjustable from the outside cover.
    k. Auxiliary devices: Air bleed and bypass valve assembly with shut off valves in the sensing lines
    l. Acceptable Manufacturers:
        1) Honeywell Controls
        2) Veris
        3) Setra.
        4) Engineer approved equal

2.8 SYSTEM OUTPUT CONTROLLED DEVICES

A. PILOT CONTROL RELAYS: Pilot Control relays shall provide either momentary or maintained switching action as appropriate for the application. Relay contact configuration, amp, voltage, and coil ratings shall be suitable for application. All panel mounted control relays shall:
   a. Be plugged in type with an interchangeable module (Ice Cube)
   b. Be mounted on a subbase and wired to numbered terminals strips.
   c. Be DPDT with indicating lamp.
2. Remotely mounted pilot control relays (outside of the panel) shall be enclosed in a NEMA enclosure suitable for the location. RIB style relays shall be acceptable for remote control.
3. All control relays shall be labeled with UR symbol and UL listed.
4. Acceptable Manufacturers:
   a. Functional Devices
   b. Veris
   c. IDEC
   d. Engineer approved equal.

2.9 FIELD DEVICES

A. CONTROL POWER TRANSFORMERS & POWER SUPPLIES: Control power transformers shall be UL listed, Class 2 current limiting type, or shall be furnished with over current protection with primary and secondary circuits for Class 2 service. Unit power output shall match the required output current and voltage requirements. Current output shall allow for a 50 percent safety factor. Output ripple shall be 3.0 mV maximum Peak to Peak. Regulation shall be 0 to 10 percent line and load combined, with 50 microsecond response time for 50 percent load changes. Unit shall have built in over voltage protection. Unit shall operate between 32 to 120 degrees F. Unit shall be UL recognized.
1. Acceptable Manufacturers:
   a. Honeywell Controls
   b. Functional Devices
   c. Engineer approved equal.

B. BMS CONTROL CABLING
1. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Division 26 unless otherwise noted herein. All insulated wire to be copper conductors, UL labeled for 90 degrees C minimum service. Electronic and fiber optic cables for control wiring are specified in Electrical Section "Voice and Data Communication Cabling."
2. Communication and Control Wiring: Wire Sizing and Insulation shall comply with minimum wire size and insulation based on services listed below:
3. Service — Minimum Gage/Type — Insulation Class
   a. AC 24 VAC — Power 12 Ga Solid — 600 Volt
   b. DC 24 VDC — Power 10 Ga Solid — 600 Volt
   c. Class 1 — 14 Ga Stranded — 600 Volt
   d. Class 2 — 18 Ga Stranded — 300 Volt
   e. Class 3 — 18 Ga Stranded — 300 Volt
   f. Open plenum rated cable is permitted in supply or return air plenum where allowed.
4. Power Wiring:
   a. 115 VAC power circuit wiring > 100 feet distance shall use minimum 10 gage.
   b. 24 VAC control power wiring > 200 feet distance shall use minimum 12 gage.
5. Control Wiring:
   a. Digital Input/Output wiring shall use Class 2 twisted pair, insulated.

b. Analog inputs shall use Class 2 twisted shielded pair, insulated, and jacketed and require a grounded shield.

6. Communication Wiring:
   a. Ethernet Cable shall be minimum CAT5e minimum
   b. Secondary level network shall be 24 gage, TSP, low capacitance cable
7. Approved Cable Manufacturers:
   a. Anixter
   b. Belden

PART 3 - EXECUTION

3.1 OVERVIEW

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 Mechanical Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field shall 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.

3.2 BMS SPECIFIC REQUIREMENTS

A. GRAPHIC DISPLAYS: Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library. User shall access the various system schematics via a graphical penetration scheme and/or menu selection.

B. END DEVICE ACTUATION: All damper and valve actuation shall be DDC electronic. Controls shall be provided by the BMS manufacturer as specified herein.

3.3 EXAMINATION

A. CONDITIONED POWER: Verify that conditioned power supply is available to the operator workstation.

3.4 CODE COMPLIANCE

A. NEC COMPLIANCE: All wiring shall be installed in accordance with all applicable electrical codes and shall comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring specifications in this section and Electrical sections, the stricter wiring requirements shall prevail.

3.5 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. All electrical control wiring to the control panels shall be the responsibility of the BMSC.

B. All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes.

C. Control wiring shall be of adequate length for the installation. Excess wire shall not be looped or coiled in the controller cabinet.

D. Use approved optical isolation and lightning protection when penetrating building envelope.

E. Read installation instructions carefully. Any unavoidable deviations shall be approved by owner's rep prior to installation.

F. COMPONENT INSTALLATION REFERENCES:
1. Install raceways, boxes, and cabinets according to Electrical Section "Raceways and Boxes."
2. Install building wire and cable according to Electrical Section "Conductors and Cables."
3. Install signal and communication cable according to Electrical Section "Voice and Data Communication Cabling."
4. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
5. Install exposed cable in raceway.
6. Install concealed cable in raceway or use plenum cable installed in workmanlike fashion.
7. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
8. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
9. Number code or color code conductors for future identification and service of control system, except local individual room control cables.
10. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
11. All wire shall be copper and meet the minimum wire size and insulation class listed below:

G. POWER WIRING:
1. 120 VAC circuits used for the BMS shall be taken from panel boards and circuit breakers provided by Division 26.
2. BMS power circuits shall be dedicated to the BMS devices and shall not be used for any other purposes.
3. BACnet DDC terminal unit controllers may use power from the equipment power circuits.
4. All NEC Class 1 (line voltage) wiring shall be UL Listed and installed approved conduit according to NEC and Division 26 requirements.
5. Power wiring must meet NEC / Local standards; minimum 12 gauge, stranded, THHN
6. Power and Class One wiring may be run in the same conduit.
7. Power Wiring must be in ¾ inch EMT where concealed or exposed.
8. Where different wiring classes terminate within the same enclosure, maintain clearances, and install barriers per the National Electric Code.

H. CONDUIT RACEWAY
1. All conduit, wiring, accessories and wiring connections required for the installation of the BMS, as herein specified, shall be provided by the BMSC unless specifically shown on the Electrical Drawings under Division 26 Electrical.
2. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification.

3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Include one pull string in each conduit 3/4 in. or larger.
5. All wiring in mechanical, electrical, or service rooms—or where subject to mechanical damage— shall be installed in conduit.
6. Conceal all conduit, except within mechanical, electrical, or service rooms.
7. Conduit in finished areas shall be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction.
8. Exposed conduit shall run parallel to or at right angles to the building structure.
9. Install conduit to maintain a minimum clearance of 6 in. from high temperature equipment (e.g., steam pipes or flues).
10. Class 2 and 3 wiring and communications wiring may be run in the same conduit.
11. Support: Secure conduit with conduit clamps fastened to the structure and spaced according to code requirements. Conduit and pull boxes shall not be hung on flexible duct strap or tie rods. Conduits shall not be run on or attached to ductwork
12. Couplings and Terminations: Conduit sections shall be joined with couplings (according to code). Conduit section terminations shall be made with fittings at boxes, as needed. Conduit section terminations not ending in boxes shall have bushings installed.
13. Class Separation: Where different wiring classes terminate within the same enclosure, maintain clearances, and install barriers per the National Electric Code.
14. Dry locations: Set screw fittings are acceptable for dry interior locations.
15. Exterior & High Moisture Prone Locations: Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit sealoff fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.
16. Flexible metallic conduit: Flexible metallic conduit shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Flexible metal conduits shall not exceed 3 feet in length and shall be supported at each end.
17. Minimum Flexible metal conduit is ½ inch: Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed. Liquid tight flexible conduit shall be use in exterior locations and interior locations subject to moisture, including chiller and boiler rooms, liquid tight, flexible metal conduits shall be used.
18. Surface Raceway: Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect. Metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.
19. Conduit and Raceway Sizing: The sizing, type and provision of conduit and raceways shall be the design responsibility of the BMSC. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMSC, the BMSC shall be responsible for all costs incurred in replacing the selected components.
20. Expansion Joints: Adhere to this specification's Division 26 requirement where conduit crosses building expansion joints.
21. Junction Boxes: Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers. ¨

I. BMS CONTROL WIRING
1. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
2. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings.

EXCEPTION: Any wire run in suspended ceilings that is used to monitor critical life safety systems or control critical equipment shall be in conduit.

3. Control wire shall be plenum rated stranded #18 gauge with minimum 300 VAC insulation.
4. Input wiring shall be shielded & fire rated Teflon jacketed where concealed but accessible.
5. Wires are to be kept a minimum of three (3) inches from hot water, steam, or condensate piping.
6. Wire shall not be allowed to run across telephone equipment areas.
7. All control and interlock wiring shall comply with national and local electrical codes and Division 26 of this specification. Where the requirements of this section differ from those in Division 26, the requirements of this section shall take precedence.
8. Where the wires leave the conduit system, they shall be protected by a plastic insert.
9. Class 2 Wiring
    a. All low voltage wiring shall meet NEC Class 2 requirements. (Low voltage power circuits shall be sub fused when required to meet Class 2 current limit.)
    b. Class 2 signal wiring and 24 VAC power can be run in the same conduit.
    c. Do not install Class 2 wiring in conduit containing Class 1 wiring or tubing.
    d. Boxes and panels containing high voltage wiring and equipment may not be used for low voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
    e. Where Class 2 wires are in concealed and in accessible locations, including ceiling return air plenums, approved cables not in conduit may be used provided that cables are UL Listed for the intended application.
10. Installation: Wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 10 feet intervals.
11. Cable Support: Plenum rated cable shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical conduits, piping, or ceiling suspension systems.
12. Wiring Device Terminations: All wire-to-device connections shall be made at a terminal block or wire nut. All wire-to-wire connections shall be at a terminal strip or wire nut. Exposed terminations shall not be acceptable. Terminations shall be contained within either the device or local junction box. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
13. No Splices: All plenum rated wiring shall be installed as continuous lengths, with no splices permitted between termination points. All wiring in conduit shall be installed as continuous lengths, with no splices permitted between termination points or junction boxes.
14. Grounding: Provide for complete grounding of all applicable signal and communications cables, panels, and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

J. BACnet COMMUNICATION WIRING: The contractor shall adhere to the items listed in the “BMS Wiring” article in Part 3 of the specification. All cabling shall be installed in a neat and workmanlike manner. Do not install communication wiring in conduit or raceway containing Class 1 or other Class 2 wiring. The Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation. The BMSC shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
    1. Labeling: All communication wiring shall be labeled to indicate origination and destination data.
    2. No Splicing: All runs of communication wiring shall be unspliced length when that length is commercially available.
    3. Grounding: Grounding of coaxial cable shall be in accordance with NEC regulations article on “Communications Circuits, Cable, and Protector Grounding.” When a cable enters or exits a building, a lightning arrestor must be installed between the lines and

ground. The lighting arrestor shall be installed according to the manufacturer's instructions.

K. WALL AND FLOOR PENETRATIONS: Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

L. BMS IDENTIFICATION STANDARDS: All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

3.6 FIELD DEVICE INSTALLATION

A. The mechanical contractor shall install all mechanical devices i.e., control valves, dampers, temperature wells, pressure taps, airflow stations, etc.…

B. All Input devices shall be installed per the device manufacturer recommendation.

C. Locate components of the BMS in accessible local control panels wherever possible.

D. DAMPER ACTUATORS: Shall be firmly mounted to give positive movement and linkage shall be adjusted to give smooth continuous movement throughout 100 percent of the stroke.

E. RELAY OUTPUTS: Transient suppression shall be provided across all coils. Suppression devices shall limit transients to 150 percent of the rated coil voltage.

F. DUCT TEMPERATURE SENSORS: Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor. The sensor shall be mounted to suitable supports using factory approved element holders.

G. SPACE SENSORS: Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor or per ADA requirements. Provide lockable tamper proof covers in public areas and/or where indicated on the plans.

3.7 OUTPUT DEVICE INSTALLATION

A. All output devices shall be installed per the manufacturer's recommendation.

B. The mechanical contractor shall install all inline devices such as control valves, dampers, airflow stations, pressure wells, etc.

C. ACTUATORS: All control actuators shall be sized capable of closing against the maximum system shut off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.

3.8 OPERATOR WORKSTATIONS

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

3.9 CLEANING

A. The contractor shall clean up all debris resulting from their activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.10 IDENTIFICATION

A. CABLES: Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross referenced with asbuilt drawings.

B. ENCLOSURES: All field enclosures, other than controllers, shall be identified with a bakelite nameplate. The lettering shall be in white against a black or blue background.

C. JUNCTION BOXES: Junction box covers shall be marked to indicate that they are a part of the BAS system.

D. FIELD DEVICES: All I/O field devices (except space sensors) that are not mounted within FIPs shall be identified with name plates. All I/O field devices inside FIPs shall be labeled.

3.11 DEVICE LOCATIONS

A. PROJECT DRAWINGS: The location of sensors is per mechanical and architectural drawings.

B. SPACE SENSORS: Space humidity or temperature sensors shall be mounted away from machinery generating heat, direct light, and diffuser air streams.

3.12 SYSTEM TESTING

A. Upon completion of the control device installation, the BMSC shall load all system software and startup the system. The BMSC shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications.

B. MANUFACTURER'S FIELD SERVICE: A directly employed factory authorized & trained service technician shall inspect, test, and adjust field assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

C. EXPERTISE: The BMS shall be set up and checked by factory trained competent technicians skilled in the setting and adjustment of the BMS/DDC equipment used in this project. These technicians are experienced in the type of HVAC systems associated with this project. The BMSC 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 percent of the input and output points of the DDC system operation.

D. POINT-TO-POINT CHECKOUT: Each I/O device (both field mounted as well as those located in field interface panels) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated, and approved by the BMSC for submission to the owner or owner’s representative.

E. CONTROLLER AND WORKSTATION CHECKOUT: A field checkout of all controllers and front end equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the owner or owner’s representative by the completion of the project. All approved submitted sequences shall be tested by the control contractor before acceptance testing described below.

F. The BMS acceptance shall be contingent upon completion and review of all corrected deficiencies. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1, “Submittals.”

G. All application software shall be verified and compared against the sequences of operation. Control loops shall be exercised by inducing a setpoint shift of at least 10 percent and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.

H. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e., graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.

I. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner.

J. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

K. At the completion of the Acceptance Testing, this BMSC shall demonstrate the sequence of operations for each system to the Architect or his representative.

3.13 BMS ACCEPTANCE

A. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements

of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.

3.14 BMS OPERATOR TRAINING

A. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the BMSC shall provide onsite 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 BMSC shall provide 4 total hours of comprehensive training for system orientation, product maintenance and troubleshooting.

3.15 WARRANTY

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. REMOTE CONNECTIVITY: The Owner shall provide all Internet Service Provider services and connections (Full time high speed ISP connection recommended for remote site access (i.e., T1, ADSL, cable modem)) for the BMSC to perform BMS warranty response work. This connection shall be maintained throughout the warranty period at the Owner’s cost for remote site warranty access and support. The BMSC shall identify the specific connection requirements in a shop drawing submittal.

C. MATERIAL WARRANTY REPAIR &/OR REPLACEMENT: 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 BMSC at no expense to the Owner.

D. BMS SYSTEM ACCESS: The Owner shall grant to the BMSC 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) shall be allowed.

3.16 OPERATION & MAINTENANCE MANUALS

A. See Division 1 for requirements. O&M manuals shall include the following elements, as a minimum:
   1. Asbuilt control drawings for all equipment.
   2. Asbuilt Network Communications Diagram.
   3. General description and specifications for all components.
   4. Completed Performance Verification sheets.
   5. Completed Controller Checkout/Calibration Sheets.

3.17 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair, or replace damaged products before Substantial Completion.

SECTION 230900 APPENDIX – A - DEFINITIONS

A. DEFINITIONS: The following definitions may be used in describing the work of this Division, Additional definitions shall be declared throughout the specifications:

1. Analog: A continuously variable system or value not having discrete levels.
2. Binary: A two-state condition, i.e., “On” or “Off”.
3. Floating: A timed spanned signal using a binary input/output to operate a variable positioned actuator.
4. Automatic Temperature Control System: The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.
5. BMS Contractor (BMSC): The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner, and ongoing service provider for the BMS work.
6. Control Sequence: A pre-programmed arrangement of software algorithms, logical computation, target values and limits as required attaining the defined operational control objectives.
7. Direct Digital Control (DDC): The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative, and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.
8. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices, and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN, or the like.
9. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable codes, standards, and ordinances so as to provide a single coherent BMS as required by this Division.
10. Provide: The term “Provide” and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.
11. Furnish: The term “Furnish” and its derivatives when used in this Division shall mean supply at the BMS Contractor’s cost to the designated third party trade contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.
12. Install: The term “Install” and its derivatives when used in this Division shall mean receive at the jobsite and mount.
13. Wiring: The term “Wiring” and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.
14. Protocol: The term “protocol” and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.
15. Software: The term “software” and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.

END OF SECTION 230900

SECTION 230993 – SEQUENCE OF OPERATIONS FOR HVAC EQUIPMENT

1.1 SUMMARY

A. DESCRIPTION: This Section includes Sequence of Operations for the HVAC systems, subsystems, and equipment.

B. SINGULAR USAGE: The use of a word in the singular in this Section shall not be considered as limiting when other indications in the project's documents denote that more than one such item as being referenced.

C. INTERPRETATION AIDS: Capitalizations, headings, paragraph numbers, titles, shading, bolding, underscores, clouds, and other symbolic interpretation aids included in this Section are for are to assist in the reading and interpretation.

1.2 GENERAL

A. Low-Limit Temperature Switches shall be automatic reset type and shall be installed with time delay and latching relays. A Low-Limit Temperature Switch must sense a temperature below 40°F (adj.) for a period of 180 seconds (adj.) prior to initiating a response to a possible freeze condition. Once the Low-Limit Temperature Switch condition response has been activated, manual reset at the BMS panel shall be required to allow the system to return to normal.

B. All setpoints including internal setpoints to control algorithms shall be adjustable from the BMS operator interfaces. All commands shall be overridable from all BMS operator interfaces. All control points shall be adjustable or overridable from the same graphic page that displays the points.

C. All points for a specific mechanical system shall be connected to and controlled by the same DDC controller unless otherwise specified. i.e., it shall not be acceptable to control a supply fan with one (1) DDC controller located at a motor control center and to control the rest of the air-handling unit points with a DDC controller located at the air-handling unit.

D. All points required by the sequence of operation including, but not limited to, the points listed in the sequences of operation below, as well as all of the points' associated values, shall be connected to the BMS and available to the BMS operators on all operator workstations and all operator interface devices as part of a graphical display that depicts the mechanical system controlled.

E. Low-Limit Temperature Switches, pressure safeties, interlocked dampers, etc. shall be wired to shutdown motors when the HOA switch is in both the hand and auto positions. It shall not be possible to override these or any other safety devices or any fire alarm system control functions, except in the case of an engineered smoke control system in which case freeze protection safeties shall be overridden.

F. The point lists are provided for convenience and are not intended to be all-inclusive. All points required to provide the Sequence of Operation shall be included as if listed.

G. Space thermostats shall be provided with clear-locking thermostat guards.

H. Refer to the Control Diagrams included in the mechanical drawings for additional information to facilitate the interpretation of the sequences of operation as defined herein. The Control Diagrams are for reference only. All points included herein or required by the sequence of operation are required regardless of whether they are shown in the Control Diagrams.

1.3 COORDINATED SEQUENCES and BMS DIAGRAMS

A. PROJECT BMS DIAGRAMS: The Sequences of Operations detailed below are predicated on the specific Project BMS diagrams. Reference the BMS Diagrams for the Unit configuration, BMS control devices, point types and locations for each device.

B. CONTROL SEQUENCE DESCRIPTIONS: The control sequences below describe all necessary equipment operation including those operations that are provided by the HVAC Equipment Unit manufacturers (UM) and those as part of the Building Management System (BMS).

1.4 RESPONSIBILITIES

A. BUILDING MANAGEMENT SYSTEM CONTRACTOR (BMSC)'S RESPONSIBILITIES: The BMSC shall provide, field install and wire all necessary software and hardware, wiring, and computing equipment in compliance with this specification. The BMSC shall also provide programming, interface design, startup services by competent technicians that regularly employed by the BMSC with full responsibility for proper operation of the control system including debugging and proper calibration of each component in the entire system. The BMSC shall provide power supply wiring to all external control panels, actuators (valves, dampers, etc.), including low voltage transformers, including the power for devices required for operation of BACnet communication as provided as part of complete UM provided BACnet packaged.

B. MECHANICAL CONTRACTOR (MC)'S RESPONSIBILITIES: The MC shall provide coordination between the UM and the BMSC to provide a fully coordinated and operational BMS. Refer to this and the specific equipment specifications and schedules for devices provided, installed, and wired by the UM and those by the BMSC.

C. EQUIPMENT UNIT MANUFACTURER (UM)'S RESPONSIBILITIES: The UM shall provide the equipment and field labor to meet the sequence requirements of this specification and schedules sections. The UM shall provide factory installation and wiring of the BMS provided controls, when specified to be factory installed

1.5 OPERATOR INTERFACE REQUIREMENTS:

A. The BMS Control Diagrams and the tables below shall provide for Operator Control of the HVAC equipment through an accurate depiction of the devices within the unit, along with the I/O points, parameters and alarms shall be displayed on a customized 3-dimensional web-based graphic.

1.6 SYSTEM TRENDS

A. DATA COLLECTION: Unless noted otherwise, the BMS shall record the Analog Trend data samples every 5 minutes. Binary Trends shall record data samples every Change of Value (COV).

1.7 BMS SYSTEM DEMOLITION

A. COORDINATION: The Owner shall inform the MC and BMSC of any equipment that is to be removed which shall remain the property of the Owner. The BMSC shall remove controls devices, which shall not remain as part of the BMS, all associated abandoned wiring and conduit; dispose of all control devices, equipment, which the Owner opts not to keep.

1.8 SUPERVISORY NETWORK CONTROLLER (SNC):

A. COORDINATION: The BMSC shall provide a new SNC. This shall include providing customized graphics and programs; of the new DDC equipment.

B. COMMUNICATIONS OFFLINE ALARM (COMM): Anytime communication is lost to a BMS DDC Controller a Communication Lost Alarm (COMM) shall be sent to the GUI.

1. Alarms

Supervisory Network Controller	**Alarms and Conditions**		
Alarm Name	Point	Normal	Alarm
BACnet Interface Alarms			
Communications Offline Alarm	Comm	Off	On

1.9 OUTSIDE AIR CONDITIONS

A. COORDINATION: The BMSC shall provide, install, and wire an Outside Air sensors with weather and sunshields on a northern exposure of the building.

B. GLOBAL BROADCAST: The Outside Air conditions shall be monitored for use by the BMS. The sensors shall be mounted on a Northern exposure of the Building and shall be protected as to not to be affected by erroneous conditions. i.e., sun, rain, open doors, etc.…

C. SENSOR FAILURE (SENSOR): Anytime the value of a Sensor is greater or less than the operational limitations of the sensor, a Sensor Failure alarm (SENSOR) shall be sent to the GUI.

D. OPERATOR INTERFACE REQUIREMENTS:

1. Input/Output Points:

Outside Air Conditions	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
Outside Air Temperature (OAT)	X				X	X	TS-O
Outside Air Humidity (OAH)	X				X	X	RH-O
Outside Air Carbon-Dioxide (OACO2)	X				X	X	CO2-O

2. Control Parameters and Settings

Outside Air Conditions	Parameters and Settings			
Parameter Name/Description X = Display on GUI A = Adjustable	AV	Trend	GUI	Initial-Setting
Calculated Degree Day – Heating	X	X	X	
Calculated Degree Day – Cooling	X	X	X	
Highest Value (Past 24 hours)	X	X	X	
Lowest Value (Past 24 hours)	X	X	X	
All Alarm Setpoints and/or Parameters	A	X	C	Alarm settings

Alarm Reset	A	X	X	

3. Alarms

Outside Air Conditions	Alarms and Conditions		
Alarm Name	Point	Normal	Alarm
Temp Sensor Failure (SENSOR)	Varies	Sensor Out of Operational Range	

1.10 HOT WATER PUMP CONTROL

A. GENERAL DESCRIPTION: Reference the BMS diagrams for configuration, BMS devices, point types and locations.

B. COORDINATION: The BMSC shall provide, and field install and all required BMS devices to provide the following sequence of operation.

C. HARDWIRED CONTROL POINTS: The BMSC shall provide the following hardwire wiring control of the Hot Water Pump VFD:
1. Hot Water Pump Start/stop command (HWP#SS)
2. Hot Water Pump status (HWP#ST)
3. Hot Water Pump Speed control signal (P#AO)(P2 & P3 Only)

D. HOT WATER PUMP START COMMAND: The selected Primary Hot Water Pump (P1SS) shall be commanded to “start” when the Heating System is enabled.

E. HOT WATER PUMP STOP COMMAND: The Boiler Hot Water Pump (P1SS & P2SS) shall be commanded to “stop” 30 minutes have passed after the Heating System has been commanded to “stop” or if after a delay of 30 seconds of the Lead Hot Water pump status (P1ST or P2ST) not proving on

F. SECONDARY LEAD HOT WATER PUMP (P2 or P3) ROTATION: The Secondary Lead Hot Water Pump (LEADHWP) shall be rotated every 168 hours of accumulated Run time or as selected from the GUI.

G. SECONDARY LAG HOT WATER PUMP START (P2 or P3): The Secondary Lag Hot Water Pump (P#SS) shall be commanded to “start” if the selected Lead Hot Water Pump (P#ST) fails to “start” after a delay of 30 seconds.

H. HOT WATER PUMP FAILURE ALARM (FAIL): If the Hot Water Pump command (P#SS) is on, but the Hot Water Pump status (P#ST) is “off”, a Pump Failure (FAIL) alarm shall be sent to the GUI.

I. HOT WATER PUMP IN HAND ALARM (HAND): If the Hot Water Pump command (P#SS) is commanded to “stop”, but the Hot Water Pump status (P#ST) is “on”, a Pump-in-Hand (HAND) alarm shall be sent to the GUI.

J. OPERATOR INTERFACE REQUIREMENTS:
1. Input/Output Points:

Hot Water Pump	**I/O Points**						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
BACnet Communication Interface Points	X	X	X	X	X	X	UMD
Hot Water Pump Start/Stop (P#SS)				O	X	X	R
Hot Water Pump Status (P#ST)			X		X	X	CS

Hot Water Pump	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
Hot Water Pump Speed (HWP#AO)		X			X	X	

2. Control Parameters and Settings

Hot Water Pump	Parameters and Settings			
Parameter Name/Description X = Display on GUI A = Adjustable	AV	Trend	GUI	Initial- Setting
BACnet Interface Parameters	A	X	X	
Lead Hot Water Pump (LEADHWP)	A	X	X	

3. Alarms

Hot Water Pump	Alarms and Conditions		
Alarm Name	Point	Normal	Alarm
BACnet Interface Alarms			
Pump Failure Alarm (FAIL)	HWP#SS HWP#ST	HWP#SS = ON HWP#ST = ON	HWP#SS = ON HWP#ST = OFF
Pump in Hand Alarm (HAND)	HWP#SS HWP#ST	HWP#SS = OFF HWP#ST = OFF	HWP#SS = OFF HWP#ST = ON

1.11 HOT WATER SYSTEM DIFFERENTIAL PRESSURE CONTROL

A. COORDINATION: The BMSC shall provide a differential pressure sensor (HWDP) across each end of the hot water mains (as approved by the engineer).

B. HOT WATER SYSTEM PRESSURE BYPASS VALVE: When the Hot Water Pump Status (P#ST) indicates a Hot Water Pump is “on”, the Hot Water Bypass control valve (HWBYP) shall modulate to maintain the Hot Water System Differential Pressure (HWDP) at the Hot Water System Differential Pressure Setpoint (HWDPSP).

C. HOT WATER SYSTEM PRESSURE ALARM (HWDPT): If the Central Heating System (HTGENB) System is enabled, after a 15 minute (adj.) delay, the Hot Water System Differential Pressure (HWDP) is not within +/- 10% of the Hot Water System Differential Pressure Setpoint (HWDPSP), a HW System DP alarm (HWDPT) shall be sent to the GUI.

D. OPERATOR INTERFACE REQUIREMENTS:

1. Input/Output Points:

HW System Differential Pressure Control	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
HW System Differential Pressure (HWDP)	X				X	X	DPT
Hot Water Bypass control valve (HWBYP)			X		X	X	CS

2. Control Parameters and Settings

HW System Differential Pressure Control	Parameters and Settings			
Parameter Name/Description X = Display on GUI A = Adjustable	AV	Trend	GUI	Initial- Setting
HW System DP Setpoint (HWDPSP)	A	X	X	15 psid

3. Alarms

HW System DP Control	**Alarms and Conditions**		
Alarm Name	Point	Normal	Alarm
HW Sys DP alarm (HWDPT)	HWDP		>+/- 10% HWDPSP

1.12 HOT WATER TEMPERATURE SETPOINT

A. GENERAL DESCRIPTION: Reference the BMS diagrams for configuration, devices, point types and locations.

B. SETPOINT OPTIMIZATION (BMS): The Outside Air Temperature sensor (OAT) shall allow the BMS to reset the Hot Water Setpoint (HWSP). This shall be a proportional inverse function.
1. When the OAT is 20 °F, the HWSP shall be 180 °F
2. When the OAT is 65 °F, the HWSP shall be 115 °F
3. The HWSP shall be limited to between 115 °F and 180 °F.

C. OPERATOR INTERFACE REQUIREMENTS:
1. Input/Output Points:

HWS Temperature Setpoint	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
Outside Air Temperature (OAT)		O			X	X	TS-O

2. Control Parameters and Settings

HWS Temperature Setpoint	Parameters and Settings			
Parameter Name/Description X = Display on GUI A = Adjustable	AV	Trend	GUI	Initial-Setting
HW Supply Temperature Setpoint (HWSP)	A	X	X	See sequence

1.13 HOT WATER TEMPERATURE CONTROL

A. ENABLE: When any Hot Water pump status (P#ST) status indicates on, the Hot Water Control valve (HWV) shall modulate to control the Hot Water Supply Temperature (SHWS) at the Hot Water Setpoint (SHWSP)

B. OPERATION: When the secondary Hot Water Supply Temperature (SHWS) is greater than the Secondary Hot Water Supply Setpoint (SHWSP), the Hot Water Coil control valve (HWV) shall modulate to “close”. When the secondary Hot Water Supply Temperature (SHWS) is less than the Secondary Hot Water Supply Setpoint (SHWSP), the Hot Water Coil control valve (HWV) shall modulate “open”.

C. OPERATOR INTERFACE REQUIREMENTS:
1. Input/Output Points:

Hot Water Pump	**I/O Points**						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
Hot Water Control Valve (HWV)		O			X	X	R
Hot Water Supply Temperature (SHWS)	X				X	X	TS-I

2. Control Parameters and Settings

Hot Water Pump	Parameters and Settings			
Parameter Name/Description X = Display on GUI A = Adjustable	AV	Trend	GUI	Initial- Setting
HW Supply Temperature Setpoint (HWSP)	A	X	X	(See Seq.)

3. Alarms

Hot Water Pump	Alarms and Conditions		
Alarm Name	Point	Normal	Alarm
HWS Temp alarm (TEMP)	HWS		HWS >+/- 10°F HWSP
Temp Sensor Failure (SENSOR)	Varies	-10°F < Input Input < 240°F	-10°F > Input Input > 240°F

1.14 EMERGENCY SHUTDOWN SWITCHES - BOILER

A. COORDINATION: The Division 26 Electrical Contractor shall provide, field install and wire the Emergency Boiler Shutdown Door Switches at each entrance to the MER. This shall include all necessary devices, switches, and contactors.

B. NORMAL CONDITION: During Normal Operations, the Emergency Shutdown Switch allows the boilers to be powered and operate according to their scheduled sequence of operations.

C. EMERGENCY BOILER SHUTDOWN:: When any of the Emergency Boiler Shutdown switches are activated, the boilers shall have their power disconnected through a contactor.

1.15 BOILER SAFETIES and CONTROLS

A. HIGH TEMPERATURE LIMIT SWITCH (HTLS): When the High Temperature Limit Switch (HTLS) senses a water temperature above the local setting of 200 °F (adj.), the boiler shall be commanded “off”. When the water temperature drops below the HTLS’s hysteresis band, the boiler shall be allowed to operate.

B. HIGH TEMPERATURE CUTOUT (HTCO): When the High Temperature Cutout switch (HTCO) senses a water temperature above its local setting of 220 °F (adj.), the boiler shall be commanded “off”. A manual push-button reset on the HTCO is required before the boiler is enabled to operate.

C. LOW WATER CUTOUT SWITCH (LWCO): When the Low Water Cutout switch (LWCO) detects a low water level condition, the boiler shall turn “off”. When the boiler water level is greater than the hysteresis band of the LWCO, the boiler shall be enabled to operate.

1.16 GAS DETECTION SYSTEM (GDS)

A. COORDINATION: The BMSC shall provide, field install and wire a Gas Detection System (GDS), including the field gas sensors and alarm panels.

B. Carbon-Monoxide (CO): The Gas Detection System (GDS) shall consist of a carbon monoxide sensor (CO) located 2-3 feet above the floor.

C. Natural Gas (CH4): The Gas Detection System (GDS) shall consist of a Natural Gas sensor (NH4) located above the boilers.

D. HARDWIRED POINTS: The GDS shall have contact alarm outputs for interfacing to the BMS. The BMSC shall provide the following hardwire wiring points to the GDS:
1. Gas Low Level Alarm (GDS-LL)
2. Gas High/Fault Level Alarm (GDS-HL)

E. Alarm Settings

Monitored Gas Name	**SYM**	**LOW**	**HIGH**	**TWA**	**STEL**
CARBON MONOXIDE	CO	35 ppm	70 ppm	35 ppm	200 ppm
METHANE	CH4	1.0% vol	1.5% vol	-25%LEL	50%LEL

F. AUDIBLE/VISUAL ALARMS: The GDS shall sound an audible and visual alarm in and just outside the MER room when in an alarm condition.

G. CALIBRATION MAINTENANCE (CALIBRATE): The BMS shall monitor the point “Hours Since Calibration (HCAL)” and shall provide a Calibration reminder (CALIBRATE) at the GUI when the Calibration Timer Setting (CAL-SP) has been reached. A software reset shall be required to reset the timer function.

H. GAS DETECTION WARNING (WARNING) ALARM: The BMS shall monitor the point “Gas Concentration (PPM / %FS)” and “Gas Low Alarm (GDS-LL)”. If the Gas Concentration (PPM / %FS) is greater than Gas Low Alarm Setting (GLSP) (adj.). A Gas Detection Warning (WARNING) Alarm shall be sent to the GUI.

I. GAS DETECTION HIGH (HIGH) ALARM: The BMS shall monitor the GDS “Gas Concentration (PPM / %FS)” and “Gas High Alarm (GDS-HL)”. If the Gas Concentration (PPM / %FS) is greater than Gas High Alarm Setting (GHSP) (adj.). A High Gas Detection (HIGH) Alarm shall be sent to the GUI.

J. OPERATOR INTERFACE REQUIREMENTS:
1. Input/Output Points:

Gas Detection System	**I/O Points**						
Point Name/Description/Legend X = DDC I/O C = Communications Interface A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
Gas Concentration (PPM or %FS)	C				X	X	RMP
Low Level contact (GDS-LL)			C		X	X	RMP
High Level contact (GDS-HL)			C		X	X	RMP
Hours Since Calibration (HCAL)	C				X	X	RMP
Sensor Fault (SENSOR)			C		X	X	RMP
Panel Fault (PANEL)			C		X	X	RMP

2. Control Parameters and Settings

Gas Detection System	**Parameters and Settings**			
Parameter Name/Description X = DDC I/O C = Communications Interface A = Adjustable	AV	Trend	GUI	Initial- Setting
Gas Low Alarm Setting (GLSP)	C	X	X	
Gas High Alarm Setting (GHSP)	C	X	X	
Calibration Timer Setting (CAL-SP)	C	X	X	Per UM setting

3. Alarms

Gas Detection System	**Alarms and Conditions**		
Alarm Name	Point	Normal	Alarm
Calibration (CALIBRATE)	C	OFF	ON

Gas Detection System	Alarms and Conditions		
Alarm Name	Point	Normal	Alarm
Sensor Fault Alarm (SENSOR)	C	OFF	ON
Panel Fault Alarm (PANEL)	C	OFF	ON
Gas Detection Warning (WARNING)	C	OFF	ON
Gas Detection High (HIGH)	C	OFF	ON

1.17 AIR HANDLING UNIT 2

A. COORDINATION (BMSC DDC): The Building Management System Contractor (BMSC) shall provide, field install and wire a BACnet DDC controller, control valves, sensors, relays, status sensors and dampers actuators. The Unit's shall be provided as outlined under the equipment schedules. The Mechanical contractor (MC) shall provide coordination between the UM and the BMSC for a complete integrated system.

B. "OPTIMAL START / STOP": The DDC controller shall calculate how long it will take to go to the next scheduled setpoint based on the heating or cooling capacity and the outside air temperature. The system will not adjust the starting or stopping by more than 2 hours.

C. SCHEDULING (BMSC DDC) : The unit's schedule (SCHED) is as established in the BMS GUI and shall be communicated to the Unit's DDC controller. The unit's DDC controller shall have a built-in timeclock.

D. SCHEDULE OVERRIDE PUSHBUTTON: A schedule Override Pushbutton (OVRD) on the Space Temperature Sensor (RMT) shall override the schedule when the button is depressed. An LED shall indicate that the Unit is overridden to "Occupied" for up to 3 hours (adj.). The Unit shall revert to its scheduled mode upon the time expiration of the override or upon further depression

E. "PROOF OF OPERATION": A current switch shall monitor the Unit's Supply fan status (SFST). The unit shall remain in "Unoccupied" until the Supply Fan status (SFST) indicates on.

F. MODE INHIBIT: During the any cooling mode all heating modes shall be disabled. During the any heating mode all cooling modes shall be disabled.

G. "UNOCCUPIED" : The Unit's fans (SFSS/EFSS) shall be commanded to "stop". the Outside Air damper (OAD) and Exhaust Air Damper (EAD) shall be commanded to "close"; the Return dampers (RAD) shall be commanded "open"; the Direct eXpansion Cooling shall be "off"; the Heating Coil control (HTG) shall modulate be "off".

H. "OCCUPIED": When the is scheduled to "Occupied" (SCHED), the Supply fan (SFSS) shall be commanded to "start". The Outside Air damper (OAD), Exhaust Air damper (EAD) and Return Air damper (RAD) shall "open" to the Minimum Outside Air setting (adj.)(OAMINSP) Upon the transition of the unit to "Occupied" mode, a 10 minute ramp shall be implemented before the Outside dampers (OAD) can go fully "open".

I. "COOLING": When the number of zones requesting cooling (CLGREQ) is greater than the Minimum zones to "start" limit (CLGRUN), if not schedule to "Run" already, the Supply fan (SFSS) shall be commanded to "start". When the current switch on the Supply Fan status (SFST) indicates "on", the Direct eXpansion Cooling (CLG) shall be sequenced "on" to maintain a Discharge Air Setpoint (DASP)(See SOURCE TEMPERATURE OPTIMIZATION (STO).

J. "HEATING": When the number of zones requesting heating (HTGREQ) is greater than the Minimum zones to "start" limit (HTGRUN), if not schedule to "Run" already, the Supply fan (SFSS)

shall be commanded to “start”. When a current switch on the Supply Fan status (SFST) indicates “on” the Heating Control valve(HTG) shall be modulated to maintain a Discharge Air Setpoint (DASP)(See SOURCE TEMPERATURE OPTIMIZATION (STO).

K. “WARM-UP”: The Unit will be in “Warmup” when the Return Air Temperature (RAT) is less than the “Warm-up” setpoint (WUSP) of 66 °F (adj.). During the “Warm-Up”, the Outside Air damper (OAD) and Exhaust Air damper (EAD) shall be commanded to “close”; The Return Air damper (RAD) shall be commanded to “open”; The Heating Coil control (HTG) shall be modulated to maintain a Discharge Air Setpoint (DASP) of 85 °F (Adj.). When the Return Air Temperature (RAT) returns above “Warm-Up” Setpoint hysteresis the Unit shall revert to the scheduled operation.

L. MINIMUM OUTSIDE AIR: The unit’s Outside Air Damper (OAD) and Return Air Damper (RAD) shall be positioned as required per the sequence of operations. The TAB shall adjust and set the Minimum Outside Air setting (MINOA). The unit’s Outside Air Damper (OAD) and Return Air Damper (RAD) shall be positioned as required per the sequence of operations.

M. DUCT STATIC PRESSURE CONTROL: The Supply Fan VFD speed (SFAO) shall be modulated to maintain the Duct Static Pressure (DPT), located approximately 2/3 distance downstream of the Supply Air Fan, at the Duct Static Pressure Setpoint (DPSP). When the Duct Static Pressure (DSP) is less than the Duct Pressure Setpoint (DPSP), the Supply Fan VFD speed (SFAO) shall increase. When the Duct Static Pressure (DSP) is greater than the Duct Pressure Setpoint (DPSP), the Supply Fan VFD speed (SFAO) shall decrease.

N. DUCT PRESSURE SETPOINT (DPSP) RESET: The initial Duct Static Pressure setpoint (DPSP) shall be 1.5 “w.c. (adj.). The unit’s associated VAV box DDC controllers shall provide the unit’s DDC controller a request to increase the duct static pressure (DSP) to a maximum of 1.8 inches w.c. (adj.). if any of the associated VAV box’s CFM cannot reach their CFMSP.. As VAV Air Flow demand decreases, the Duct Static Pressure setpoint (DPSP) shall be incrementally reset down to a minimum of 1.0 “w.c.(adj.).

O. MINIMUM OUTSIDE AIR: When the Unit’s Supply Fan status (SFST) is on, the Outside Air damper (OAD) and Return Air damper (RAD) shall modulate to maintain the Outside Air Flow (OACFM) at the Minimum Outside Air setting (OAMINSP).

P. “DEHUMIDIFICATION” (DIRECT EXPANSION): When the Return Humidity (RARH) is greater than the Relative Humidity Setpoint (RHSP) the Direct eXpansion Cooling (DX) shall be sequenced “on”, and the Hot Gas reheat coil (HGRH) shall be commanded “on”. When the Return Humidity (RARH) is less than the Relative Humidity Setpoint (RHSP) hysteresis, the Direct eXpansion Cooling (DX) shall be sequenced “off”, and the Hot Gas reheat coil (HGRH) shall be commanded “off”.

Q. FILTER MAINTENANCE (FILTER): Each filter bank shall be monitored by a Filter Differential Pressure Switch (FILTER) that shall be locally set per the filter rating for a dirty filter. When the Filter Differential Pressure Switch (FILTER) exceeds this rating, a Filter maintenance (FILTER) alarm shall be sent to the GUI. A software reset shall be required to silence/reset the timer function.

R. SPACE HUMIDITY (HUMIDITY) ALARM: When the Unit’s Supply Fan (SFSS) is commanded “on” and If the Return Humidity (RARH) is more than 10%r.h. (adj.) from the Relative Humidity Setpoint (RHSP) setpoints. A Return Air Humidity Alarm (HUMIDITY) shall be sent to the GUI.

S. LOW LIMIT SWITCH (LLSTRIP) ALARM: A Low Temperature Limit Switch (LLS) shall be located on the leaving airside of the Heating Coil. If the Low Temperature Limit Switch (LLS) senses a coil discharge temperature below the local device setting of 38 °F; the Unit’s Fan (SFSS) shall be

commanded to “stop”; the Outside Air damper (OAD), Exhaust Air damper (EAD) shall be commanded to “close”; the Return Air damper (RAD) commanded “open”. The Heating Coil control valve (HTG) shall “open” to the coil. The unit’s cooling sequences shall be disabled. A Low-Limit Switch Tripped (LLSTRIP) shall be sent to the GUI. The Low Temperature Limit Switch (LLS) shall be reset from the GUI.

T. LIQUID DETECTION (LIQUID) ALARM: A Liquid Detection (LDS) switch shall be located to detect accumulated liquids in the Drip Pan. Upon detection of a liquid the Unit’s Supply Fan (SFSS) shall be commanded to “stop”; the Outside Air damper (OAD) and Exhaust Air damper (EAD) shall be commanded to “close”; the Return Air damper (RAD) commanded to “open”. The unit’s cooling sequences shall be disabled. The Heating Coil control valve (HTG) shall be commanded “open” to the coil. A Drip Pan Liquid Detection (LIQUID) alarm shall be sent to the GUI. The alarm shall be reset through a software switch from the GUI.

U. COOLING FAILURE ALARM (COOLFAIL - DAT): If the Discharge Air Temperature (DAT) remains within 4°F (adj.) of the Mixed Air Temperature (MAT) after with the cooling mode is utilized (for greater than 5 minutes). A Cooling Failure alarm (COOLFAIL) shall be sent to the GUI. This alarm shall not be enabled until the Supply Fan status (SFST) has been “on” for 10 minutes (adj.).

V. HEATING FAILURE ALARM (HEATFAIL - DAT): If the Discharge Air Temperature (DAT) remains within 4°F (adj.) of the Mixed Air Temperature (MAT) after of the heating signal is greater than 10% “open” (For greater than 5 minutes) This alarm shall not be enabled until the zone has been “on” for 10 minutes (adj.). A Heating Failure alarm (HEATFAIL) shall be sent to the GUI. This alarm shall not be enabled until the Supply Fan status (SFST) has been “on” for 10 minutes (adj.).

W. DISCHARGE AIR LOW ALARM (DATLO): If the Discharge Air Temperature (DAT) decreases below the Discharge Air Temperature Low Limit Setpoint (DALL) or 45°F (adj.), the Outside Air damper (OAD), Exhaust Air damper (EAD) shall be commanded to “close”, The Return Air damper (RAD) commanded to “open”, and an alarm (DATLO) shall be sent to the GUI. This sequence shall be disabled during any cooling mode of operation.

X. MIXED AIR TEMPERATURE ALARM (DAMPER): If the Outside Air Temperature (OAT) is lower than the Mixed Air Temperature Setpoint (MASP), then if the Mixed Air Temperature (MAT) fails to be with 4°F of the Mixed Air Temperature Setpoint (MASP) or if the Mixed Air Temperature (MAT) is greater than 80 °F(adj.) or less than 45°F (adj.), then an alarm (DAMPER) shall be sent to the GUI.

Y. FAN FAILURE ALARM (FAIL): If a Fan (i.e., SFSS, RFSS, etc..) is commanded to “start”, but the Fan status (i.e., SFSS, RFSS, etc..) is “off”, a Fan Failure (FAIL) alarm shall be sent to the GUI.

Z. FAN IN HAND ALARM (HAND): If a Fan command (i.e., SFSS, RFSS, etc..) is commanded to “stop”, but the Fan status (i.e., SFST, RFST, etc..) is “on”, a Fan-in-Hand (HAND) alarm shall be sent to the GUI.

AA. FAN FAULT ALARM (FAULT): If the Unit’s Fan Variable Frequency Drive Fault contact (i.e., SFFLT, RFFLT, etc..) is detected, a Fan VFD Fault alarm shall be sent to the GUI.

BB. DUCT STATIC PRESSURE ALARM (DSTATIC): When the Unit’s Supply Fan (SFSS) is commanded “on”, and the Duct Static Pressure (DSP) is more than 10% from the Duct Pressure Setpoint (DPSP) a Duct Static Pressure alarm (DSTATIC) shall be sent to the GUI.

CC. BUILDING PRESSURE ALARM (BSTATIC): When the Unit’s Return Fan (SFSS) is commanded “on”, and the Building Static Pressure (BSP) is more than 10% from the Building Pressure Setpoint (DPSP) a Building Static Pressure alarm (BSTATIC) shall be sent to the GUI.

DD. TEMPERATURE SENSOR FAILURE (SENSOR): Anytime the value of a Temperature Sensor is greater or less than the operational limitations of the sensor, a Temperature Sensor Failure alarm (SENSOR) shall be sent to the GUI.

EE. DUCT SMOKE DETECTION (SMOKE): The BMSC shall wire the spare contact on the Unit's Smoke Detectors (SDD) to BMS DDC controller to disable control loops during a smoke condition. The Division 26 Electrical Contractor (EC) shall provide the provide the smoke detectors with a spare contact for use by the BMS system; The EC shall also wire the interlock for the Unit shut down. The Division 23 Mechanical Contractor shall be install the smoke detectors. A Smoke Detection alarm (SMOKE) shall be sent to the GUI.

FF. OPERATOR INTERFACE REQUIREMENTS:

1. Input/Output Points:

AHU 2	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
BACnet Communication Interface Points	X	X	X	X	X	X	UMD
Supply Fan Start/Stop (SFSS)				O	X	X	R
Supply Fan Status (SFST)			X		X	X	CS
Supply Fan Fault (SFFLT)			X		X	X	
Supply Fan Speed (SFAO)		X			X	X	
Direct eXpansion Cooling (CLG)		O		O	X	X	
Heating Coil control valve (HTG)		O		O	X	X	
Duct Static Pressure (DSP)	X				X	X	DPT
Building Static Pressure (BSP)	X				X	X	DPT
Return Air Humidity (RAH)	X				X	X	RH-D
Discharge Air Temperature (DAT)	X				X	X	TS-D
Mixed Air Temperature (MAT)	X				X	X	TS-A
Return Air Temperature Setpoint (RAT)	X				X	X	TS-D
Outside Air Damper (OAD)		O		X	X	X	M
Return Air Damper (RAD)		O		X	X	X	M
Exhaust Air Damper (EAD)		O		X	X	X	M
Filter (FLTR)			X		X	X	DPS
Liquid Detection Sensor (LDS)			X		X	X	LDS
Outside Air Flow (OACFM)	X				X	X	AFS
Duct Smoke Detector (SDD)			X		X	X	SDD

2. Control Parameters and Settings

AHU 2	Parameters and Settings			
Parameter Name/Description X = Display on GUI A = Adjustable	AV	Trend	GUI	Initial- Setting
BACnet Interface Parameters	A	X	X	
Occupancy Schedules (SCHED)	X	X	X	
Discharge Air Temperature Setpoint (DASP)	A	X	X	70 °F
Relative Humidity Setpoint (RHSP)	A	X	X	50 %r.h.
Discharge Air Temperature Setpoint (DASP)	A	X	X	See Sequence
Discharge Air Temperature Low Limit (DALL)	A	X	C	55°F
Mixed Air Temperature Setpoint (MASP)				See Sequence
Duct Static Pressure Setpoint (DPSP)	A	X		1.5 inches w.c.
Building Pressure Setpoint (BPSP)	A	X		0.05 inches w.c.
Space Temp "Warm-up" Setpoint (WUSP)	A	X	C	68 °F
Filter Replacement Timer (FILTERSP)				1000 hours

Minimum Outside Air damper (MINOA)				Set by Balancer
OA Intake CFM Setpoint (OACFMSP)	A	X	X	Set by Balancer
All Alarm Setpoints and/or Parameters	A	X	C	Alarm settings
Alarm Reset	A	X	X	

3. Alarms

AHU 2	Alarms and Conditions		
Alarm Name	Point	Normal	Alarm
BACnet Interface Alarms	Varies	Varies	Varies
Filter Maintenance (FILTER)	FLTR	OFF	ON
Space Temperature (TEMP)	RMT	< +/- 4°F SP	> +/-4°F SP
Humidity Alarm (HUMIDITY)	RMRH	<10%r.h. SP	>10%r.h. SP
Liquid Detection (LIQUID)	LDS	OFF	ON
Cooling Failure (COOLFAIL)	See Sequence of Operations		
Heating Failure (HEATFAIL)	See Sequence of Operations		
Discharge Air Temp (DATLO)	DAT	> 45 °F	< 45 °F
Mixed Air Temperature (MATLO)	MAT	See Sequence of Operations	
Fan Failure (FAIL)	#FSS #FSTS	#FSS = ON #FST = ON	#FSS = ON #FST = OFF
Fan in Hand (HAND)	#FSS #FSt	#FSS = OFF #FST = OFF	#FSS = OFF #FST = ON
Fan Fault Alarm (FAULT)	#FFLT	OFF	ON
Duct Static Pressure alarm	DSP		>+/- 10% SP
Building Static Pressure alarm	BSP		>+/- 10% SP
Air Flow	#ACFM		+/- 5% Set by TAB
High Air Temperature	#AT		#AT greater than #ASP+5 °F
Low Air Temperature	#AT		#AT -5 °F less than #ASP
Temp Sensor Failure (SENSOR)	Varies	-10°F < Input Input < 220°F	-10°F > Input Input > 220°F
Duct Smoke Detector (SMOKE)			

1.18 FAN POWERED - VARIABLE AIR VOLUME BOX

A. GENERAL: The variable volume (VAV) terminal unit is controlled independent of system pressure fluctuations by an Application Specific DDC controller. The space served by the VAV terminal unit is controlled in Occupied and Unoccupied modes. Provide one B-ASC DDC controller, one duct air temperature sensor and one temperature sensor for each VAV box.

B. COORDINATION: The BMSC shall provide a B-ASC VAV DDC controller, with integral actuator to the VAV Box Manufacturer's (UM) factory for mounting and wiring. Additionally, the BMSC shall provide, install, and wire a Space Temperature Sensor (RMT) and duct mounted Discharge Air Temperature (DAT) sensor. The Unit's shall be provided as outlined under the equipment schedules to include a cross flow sensor, a control power transformer and enclosure. The UM shall provide factory installation of the BMS DDC controller. The Testing and Balancing contractor (TAB) shall measure, calibrate, and adjust the VAV box air flow to the scheduled air flow setpoints.

C. SCHEDULING: The unit's schedule is as established in the BMS GUI and shall be communicated to the Unit's DDC controller. The unit's DDC controller shall have a built-in timeclock.

D. SCHEDULE OVERRIDE PUSHBUTTON: A schedule Override Pushbutton on the Space Temperature Sensor (RMT) shall override the schedule when the button is depressed. An LED shall indicate that the Unit is overridden into the “Occupied” mode for up to 3 hours (adj.). The Unit shall revert to its scheduled mode upon the time expiration of the override or upon further depression of the button.

E. SPACE TEMPERATURE SENSOR: The Space Temperature Sensors (RMT) shall have an LCD screen depicting the Temperature and Setpoints.

F. SPACE TEMPERATURE SENSOR: Space Temperature Sensor(s) (RMT) in public areas shall have a blank vented stainless steel design. The Space Heating (HSP/UHSP) and Cooling (CSP/UCSP) shall be controlled from the GUI.

G. SPACE TEMPERATURE SETPOINTS: The setpoints shall initially be 72 °F (adj.) for heating (HSP) and 74 °F (adj.) for cooling (CSP) with a setpoint adjustment span setting of ± 4 °F (adj.).

H. SOURCE TEMPERATURE OPTIMIZATION: The Duct Heating Coil’s B-ASC DDC controller shall provide requests according to the STO sequence of operations.

I. CALCULATED AIRFLOW SETPOINT: The Calculated Airflow Setpoint (CFMSP) is calculated from the temperature differential between the Space Temperature (RMT) and the Heating / Cooling Setpoints (HSP/CSP). The Calculated Air Flow Setpoint (CFMSP) shall be reset between the Maximum Airflow Setting (CFMMAX) and Minimum Airflow Setting (CFMMIN).

J. “UNOCCUPIED”: When scheduled to “Unoccupied”, the VAV Box damper (DMPR) shall be commanded to “open”.

K. “OCCUPIED”: When scheduled to “Occupied”, The Fan shall be commanded to start and the Variable Air Volume Box damper shall modulate to maintain the airflow (CFM) at the Calculated Air Flow Setpoint (CFMSP).

L. “COOLING”: When the Space Temperature (RMT) is greater than the scheduled “Cooling” Setpoint (CSP) a request shall be sent to the Supply Air Source HVAC Equipment to provide cooling. The VAV Box dampers shall be modulated to maintain the maximum air flow (CFMMAX). When the Space Temperature (RMT) has reached the scheduled “Cooling” Setpoint (CSP) a cooling request shall be no longer be sent to the Supply Air Source HVAC Equipment. The VAV Box damper shall revert to its scheduled position.

M. “HEATING”: When the Space Temperature (RMT) is greater than the scheduled “Heating” Setpoint (HSP) a request shall be sent to the Supply Air Source HVAC Equipment to provide heating. The VAV Box dampers shall be modulated to maintain the maximum airflow (CFMMAX). When the Space Temperature (RMT) has reached the “Unoccupied Heating” Setpoint (UHSP) a cooling request shall be no longer be sent to the Supply Air Source HVAC Equipment. The VAV Box damper shall revert to its scheduled position.

N. “WARM-UP”: When a “Warmup” signal is received from the Supply Air Source HVAC Equipment or if the Discharge Air Temperature (DAT) is more than 3°F higher than the Space Temperature (RMT), the VAV Box operation shall be reversed. When the “Warm-up” is complete the VAV Box shall revert back to its scheduled operation. The VAV Box shall modulate the airflow (CFM) between the minimum airflow (CFMMIN) and the heating maximum airflow (CFMMAX).

O. MINIMAL CORRECTION: The B-ASC DDC controller damper shall not move for less than one second; if the damper position correction is required to meet the calculated flow setpoint (CFMSP) which will take less than a one (1) second of damper movement, the damper shall not adjust its position.

P. EXCESSIVE CORRECTION: The B-ASC DDC controller shall monitor the total number of damper movements (open or close) during each 24 hour period. If the total number of movements in a period exceeds 700, which could indicate a control stability problem and cause excess damper motor wear, the zone will generate an alarm.

Q. HUMIDITY CONTROL: Reference Plans for locations A space relative humidity sensor shall monitor the space humidity levels (RRH). The space humidity levels (RRH). Shall be sent to the Supply Air Source HVAC Equipment for Humidity control sequences.

R. SPACE TEMPERATURE (TEMP) ALARM: If the Space temperature (RMT) is greater than 4°F (adj.) from the scheduled setpoints. A Space Temperature Alarm (TEMP) shall be sent to the GUI.

S. SPACE HUMIDITY (HUMIDITY) ALARM: If the Space Humidity (RMRH) is more than 10%r.h. (adj.) from the Relative Humidity Setpoint (RHSP) setpoints. A Space Humidity Alarm (HUMIDITY) shall be sent to the GUI.

T. AIR FLOW ALARM (AIRFLOW)(VAV): If the Airflow (CFM) is greater than 10% (adj.) from the Calculated Airflow Setpoint (CFMSP). An Airflow Alarm (AIRFLOW) shall be sent to the GUI.

U. SENSOR FAILURE (SENSOR): Anytime the value of a Sensor is greater or less than the operational limitations of the sensor, a Sensor Failure alarm (SENSOR) shall be sent to the GUI.

V. OPERATOR INTERFACE REQUIREMENTS:

1. Input/Output Points:

VAV	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
BACnet Communication Interface Points	X	X	X	X	X	X	UMD
Fan Command (FSS)				X	X	X	R
Duct Velocity Pressure (DVP)	X				X	X	DPT
Damper Position (DAMPER)		X			X	X	ASC
Space Temperature (RMT)	X				X	X	TS-W
Space Relative Humidity (RMRH)	X				X	X	RH-W
Discharge Air Temperature (DAT)	X				X	X	TS-D

2. Control Parameters and Settings

VAV	Parameters and Settings			
Parameter Name/Description X = Display on GUI A = Adjustable	AV	Trend	GUI	Initial- Setting
BACnet Interface Parameters	A	X	X	
Occupancy Schedules (SCHED)	X	X	X	
“Occupied” Space Heating Setpoint (HSP)	A	X	X	70 °F
“Occupied” Space Cooling Setpoint (CSP)	A	X	X	72 °F
“Unoccupied” Space Heating Setpoint (UHSP)	A	X	X	65 °F
“Unoccupied” Space Cooling Setpoint (UCSP)	A	X	X	78 °F
Relative Humidity Setpoint (RHSP)	A	X	X	50 %r.h.
Space Temp “Warm-up” Setpoint (WUSP)	A	X	C	2 °F (WUSP – HSP)
Airflow (CFM)	A	X	X	By Balancer
CFM Minimum Setting (CFMMIN)	A	X	X	By Balancer
CFM Maximum Setting (CFMMAX)	A	X	X	By Balancer

CFM Heating Setting (CFMHTG)	A	X	X	By Balancer
CFM Setpoint (CFMSP)	A	X	X	Calc
Alarm Reset	A	X	X	

3. Alarms

VAV – Cooling Only	Alarms and Conditions		
Alarm Name	Point	Normal	Alarm
BACnet Interface Alarms	Varies	Varies	Varies
Space Temperature (TEMP)	RMT	< +/- 4°F SP	> +/-4°F SP
Humidity Alarm (HUMIDITY)	RMRH	<10%r.h. SP	>10%r.h. SP
Air Flow	#ACFM		+/- 10% Set by TAB
Temp Sensor Failure (SENSOR)	Varies	-10°F < Input Input < 220°F	-10°F > Input Input > 220°F

1.19 CONSTANT and VARIABLE AIR BOX BALANCING

A. COORDINATION: The TAB shall provide, for their own use, a laptop computer for use of the BMS Balancing Software. Provide the initial air balancing and setting of the design minimum and maximum air flow for each box. The BMSC shall provide the BMS balancing software to the TAB for balancing the VAV boxes, along with four (4) hours of instruction and support to the air balancer.

1.20 OPTIMIZED AIR SOURCE PRESSURE (OASP):

A. DESCRIPTION: The Duct Static Pressure (DSP) shall automatically be optimized in response to the airflow needs of the System Airflow Control devices by increasing or decreasing Air Source Duct Pressure Setpoint (DPSP) The DPSP shall be calculated based on the number of System Airflow requests (CFMREQ) from the System Airflow devices which are served by the Air Source Unit.

B. OPTIMIZED SOURCE PRESSURE SETPOINT RESET ALGORITHM A Unit is a Cold Air Source for a number of Airflow Control Devices. The Unit's initial setting for the Duct Pressure Setpoint (DPSP) is 1.50 "w.c., with a Maximum Duct Pressure Setpoint (MXDPSP) of 2.0 "w.c. (adj.) and a Minimum Duct Pressure Setpoint (MNDPSP) 1.0 "w.c. (adj.). Every two (2) minutes, all of the Unit's Airflow Control Device's Airflow requests (CFMREQ) shall be totaled and the Duct Static Pressure Setpoint (DPSP) shall be calculated according to the following algorithm. The DPSP shall be subtracted by a negative 0.05 "w.c.(Trim by), then added by a positive 0.05 "w.c.(Respond by) for each Airflow Device request (CFMREQ), but not by no more than 0.20 "w.c.(Response Limit). i.e., Current DPSP + 'trim by' + ('respond by' x Total Airflow Device Request) = New DPSP.

C. OPTIMIZED SOURCE PRESSURE SETPOINT CALCULATION EXAMPLES: Case 1: If the current Duct Pressure Setpoint (DPSP) is 1.50" w.c., and If there are a total of eight (8) System Airflow requests (CFMREQ) then 1.50 "w.c. - 0.05 "w.c. + (0.05 "w.c. x 8) = 1.50 "w.c. - 0.05 "w.c. + 0.20 "w.c.(this is response limited). So, the optimized DPSP would be the New DPSP of 1.65 "w.c., Two (2) minutes later the process would repeat. Case 2: If the current Duct Pressure Setpoint (DPSP) is 1.50 "w.c., and If there are a total of zero (0) System Airflow requests (CFMREQ) then 1.50 "w.c. - 0.05 "w.c. + (+0.05 "w.c. x 0) = 1.50 "w.c. - 0.05 "w.c. + 0.00 "w.c., So, the optimized DPSP would be the New DPSP of 1.45 "w.c., Two (2) minutes later the process would repeat.

D. OPERATOR INTERFACE REQUIREMENTS:
1. Input/Output Points:

Optimized Source Pressure	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
Supply Fan Speed (SFAO)		X			X	X	
Duct Static Pressure (DSP)	X				X	X	DPT

2. Control Parameters and Settings

Optimized Source Pressure	Parameters and Settings			
Parameter Name/Description X = Display on GUI A = Adjustable	AV	Trend	GUI	Initial- Setting
Duct Static Pressure Setpoint (DPSP)	A	X		1.5 inches w.c.
Airflow Device Request (CFMREQ)	A	X	X	
Minimum Duct Pressure Setpoint (MNDPSP)	A	X	X	1.0 inches w.c.
Maximum Duct Pressure Setpoint (MXDPSP)	A	X	X	2.0 inches w.c.
Trim by Setting (TRIM)	A	-	-	minus 0.05
Respond By (RESPOND)	A	-	-	positive 0.05
Response Limit (RLIMIT)	A	-	-	0.020 inches w.c.

1.21 SOURCE TEMPERATURE OPTIMIZATION (STO)

A. Description: The Discharge Air Temperature (DAT) shall automatically be optimized for all Air Handling Units in response to the load needs of other downstream pieces of equipment, by increasing or decreasing Discharge Air Setpoint (DASP). The STO shall also provide for “start”/”stop” of the primary mechanical equipment based on zone occupancy and/or zone load conditions. The setpoint shall be calculated based on the number of heating or cooling requests which are currently being received from the equipment served.

B. Optimized Temperature Setpoint Reset Example: An Air Handling Unit is the source of cold air for a number of Variable Air Volume boxes. The initial settings of the STO program for the Air Handling Unit have the following parameters. The initial Discharge Air Setpoint (DASP) is 60.00 °F, with a Maximum setpoint of 65.00 °F and a Minimum setpoint 55.00 °F. Every two minutes, all of the Variable Air Volume box cooling requests and calculate will be totaled and a new Discharge Air Setpoint (DASP) will be calculated by performing the following algorithm. The DASP shall be increased by 0.25 °F and then decreased by 0.50 °F for each cooling request, but by no more than 2.0 °F. Current DASP + 'trim by' + ('respond by' x no. of req.) = New DASP If 8 cooling requests were received and the previous setpoint was 57.00 °F, the new DASP would be 57.00 °F + 0.25 °F + (-0.50 °F x 8) = 57.00°F + 0.25°F - 2.00°F (this is limited) = New DASP of 55.25 °F; 2 minutes later the process would repeat. If there are 0 cooling requests and the previous setpoint was 57.00 °F, the new DASP would be: 57.00 °F + 0.25 °F + (-0.50 °F x 0) = 57.00°F + 0.25°F - 0°F = New DASP of 57.25 °F; 2 minutes later the process would repeat.

C. OPERATOR INTERFACE REQUIREMENTS:

1. Input/Output Points:

Optimized Source Temperature	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
VAV Cooling Requests (CLGREQ)	X				X	X	
VAV Heating Requests (HTGREQ)	X				X	X	

2. Control Parameters and Settings

Optimized Source Temperature	Parameters and Settings			
Parameter Name/Description X = Display on GUI A = Adjustable	AV	Trend	GUI	Initial- Setting
Discharge Air Setpoint (DASP)	A	X		Calculated
Minimum Discharge Setpoint (MNDASP)	A	X	X	55 °F
Maximum Discharge Setpoint (MXDASP)	A	X	X	65 °F
Trim by Setting (TRIM)	A	-	-	minus 0.50
Respond By (RESPOND)	A	-	-	positive 0.25
Response Limit (RLIMIT)	A	-	-	2.0 °F

1.22 AIR HANDLING UNITS 1 AND 3

A. COORDINATION: The Building Management System Contractor (BMSC) shall provide, field install and wire a BACnet DDC controller, control valves, sensors, relays, status sensors and dampers actuators. The Unit's shall be provided as outlined under the equipment schedules. The Mechanical contractor (MC) shall provide coordination between the UM and the BMSC for a complete integrated system.

B. "OPTIMAL START / STOP": The DDC controller shall calculate how long it will take to go to the next scheduled setpoint based on the heating or cooling capacity and the outside air temperature. The system will not adjust the starting or stopping by more than 2 hours.

C. SCHEDULING: The unit's schedule (SCHED) is as established in the BMS GUI and shall be communicated to the Unit's DDC controller. The unit's DDC controller shall have a built-in timeclock.

D. SCHEDULE OVERRIDE PUSHBUTTON: A schedule Override Pushbutton (OVRD) on the Space Temperature Sensor (RMT) shall override the schedule when the button is depressed. An LED shall indicate that the Unit is overridden to "Occupied" for up to 3 hours (adj.). The Unit shall revert to its scheduled mode upon the time expiration of the override or upon further depression of the Override Pushbutton (OVRD).

E. PRE AND POST OCCUPANCY PURGE: Immediately prior to and after each occupancy schedule, the outdoor ventilation shall be provided in an amount equal to the lesser of the minimum required ventilation rate for 2 hour for each cycle or after 3 complete air changes.

F. SPACE TEMPERATURE SENSOR: The Space Temperature Sensors (RMT) shall have an LCD screen depicting the Temperature and Setpoints.

G. SPACE TEMPERATURE SETPOINTS: The setpoints shall initially be 72 °F (adj.) for heating (HSP) and 74 °F (adj.) for cooling (CSP) with a setpoint adjustment span setting of ± 4 °F (adj.).

H. "PROOF OF OPERATION": A current switch shall monitor the Unit's Supply fan status (SFST). The unit shall remain in "Unoccupied" until the Supply Fan status (SFST) indicates on.

I. MODE INHIBIT: During the any cooling mode all heating modes shall be disabled. During the any heating mode all cooling modes shall be disabled.

J. "UNOCCUPIED": The Unit's fans (SFSS/RFSS) shall be commanded to "stop". Any associated exhaust fans (EFSS) shall be commanded to "stop"; the Outside Air damper (OAD) and Exhaust Air Damper (EAD) shall be commanded to "close"; the Return dampers (RAD) shall be

commanded “open”; the Direct eXpansion Cooling shall be “off”; the Heating Coil control (HTG) shall modulate be “off”.

K. “OCCUPIED”: When the is scheduled to “Occupied” (SCHED), the Unit’s Return Fan (RFSS) shall be commanded to “start”, After a 15 second delay, the Supply fan (SFSS) shall be commanded to “start”. The Outside Air damper (OAD), Exhaust Air damper (EAD) and Return Air damper (RAD) shall “open” to the Minimum Outside Air setting (adj.)(OAMINSP) Upon the transition of the unit to “Occupied” mode, a 10 minute ramp shall be implemented before the Outside dampers (OAD) can go fully “open”.

L. “COOLING”: When the Space Temperature (RMT) is greater than the scheduled “Cooling” Setpoint (CSP) and conditional use of mechanical cooling air conditions is allowed, if not schedule to ‘Run” already, the Supply fan (SFSS) shall be commanded to “start”. When the current switch on the Supply Fan (SFST) indicates “on”, the Direct eXpansion Cooling (CLG) shall be sequenced “on” to maintain a Discharge Air Setpoint (DASP) of 55 °F. When the Space Temperature (RMT) decreases below the scheduled “Cooling” Setpoint (CSP) hysteresis, the Direct eXpansion Cooling (CLG) shall be sequenced “off”.

M. “HEATING”: When the Space Temperature (RMT) is less than the scheduled “Heating” Setpoint (HSP), if not scheduled to “Run” already, the Supply Fan (SFSS) shall be commanded to “start”. When a current switch on the Supply Fan status (SFST) indicates “on” the Heating Control valve (HTG) shall be modulated to maintain a Discharge Air Setpoint (DASP) of 95 °F. When the Space Temperature (RMT) rises above the “Unoccupied Heating” Setpoint (HSP) hysteresis, the Heating Control (HTG) shall be sequenced “off”.

N. “WARM-UP”: The Unit will be in “Warmup” when the Space Temperature (RMT) is greater than 5 °F (adj.) below the Space Heating Setpoint (HSP) or the Return Air Temperature (RAT) is less than the “Warm-up” setpoint (WUSP) of 66 °F (adj.). During the “Warm-Up”, the Outside Air damper (OAD) and Exhaust Air damper (EAD) shall be commanded to “close”; The Return Air damper (RAD) shall be commanded to “open”; The Heating Coil control (HTG) shall be modulated to maintain a Discharge Air Setpoint (DASP) of 85 °F (Adj.). When the Space Temperature (RMT) returns within 2 °F of the Space Heating Setpoint (HSP) the Unit shall revert to the scheduled operation.

O. “COOL-DOWN”: The Unit shall be placed in “Cool-Down” when the Return Air Temperature (RAT) is greater than the “Cool-Down” setpoint (CDSP) of 76 °F (adj.). When the Unit is in the “Cool-Down” sequence: Any associated Exhaust fan (EFSS) shall be command to “stop”; The Outside Air Damper (OAD) and Exhaust Air Damper (EAD) shall be commanded to “close”; The Return Air Damper (RAD) shall be commanded to “open”; The Cooling shall be modulated to maintain a Discharge Air Setpoint (DASP) of 55 °F (adj.); The Unit shall revert to the “Scheduled” sequence when the Return Air Temperature (RAT) less than the “Cool-Down” Setpoint (CDSP) hysteresis.

P. MINIMUM OUTSIDE AIR: The unit’s Outside Air Damper (OAD) and Return Air Damper (RAD) shall be positioned as required per the sequence of operations. The TAB shall adjust and set the Minimum Outside Air setting (MINOA).

Q. “FREE COOLING ECONOMIZER”: When the Outside Air temperature (OAT) is less than the Space Temperature (RMT) by greater than 8 °F (adj.) The use of the Free Cooling economizer shall be used to cool the Space Temperature (RMT) as required, the Outside Air Damper (OAD) and Return Air Dampers (RAD) shall modulate “open” from the minimum position to maintain the Space Cooling Setpoint (CSP) when the Outside Air conditions exist for Free-Cooling. When the Space Temperature (RMT) is greater than the Space Cooling Setpoint (CSP) the Outside (OAD) dampers shall be modulated “open”. When the Space Temperature (RMT) is less than the Space Cooling Setpoint (CSP) the Outside (OAD) dampers shall be modulated to “close”.

R. “INADEQUATE FREE COOLING ECONOMIZER”: If the Space Temperature (RMT) remains above the Space Cooling Setpoint (CSP) for greater than 15 minutes, the Outside Air damper (OAD) and Return Air damper (RAD) dampers shall return to the Minimum Outside Air position (MINOA) and the mechanical cooling shall be utilized.

S. “DEHUMIDIFICATION” (DIRECT EXPANSION): When the Return Humidity (RARH) is greater than the Relative Humidity Setpoint (RHSP) the Direct eXpansion Cooling (DX) shall be sequenced “on”, and the Hot Gas reheat coil (HGRH) shall be commanded “on”. When the Return Humidity (RARH) is less than the Relative Humidity Setpoint (RHSP) hysteresis, the Direct eXpansion Cooling (DX) shall be sequenced “off”, and the Hot Gas reheat coil (HGRH) shall be commanded “off”.

T. FILTER MAINTENANCE (FILTER): Each filter bank shall be monitored by a Filter Differential Pressure Switch (FILTER) that shall be locally set per the filter rating for a dirty filter. When the Filter Differential Pressure Switch (FILTER) exceeds this rating, a Filter maintenance (FILTER) alarm shall be sent to the GUI. A software reset shall be required to silence/reset the timer function.

U. SPACE TEMPERATURE (TEMP) ALARM: If the Space temperature (RMT) is greater than 4°F (adj.) from the scheduled setpoints. A Space Temperature Alarm (TEMP) shall be sent to the GUI.

V. SPACE HUMIDITY (HUMIDITY) ALARM: When the Unit’s Supply Fan (SFSS) is commanded “on” and If the Space Humidity (RMRH) is more than 10%r.h. (adj.) from the Relative Humidity Setpoint (RHSP) setpoints. A Space Humidity Alarm (HUMIDITY) shall be sent to the GUI.

W. LIQUID DETECTION (LIQUID) ALARM: A Liquid Detection (LDS) switch shall be located to detect accumulated liquids in the Drip Pan. Upon detection of a liquid the Unit’s Supply Fan (SFSS) shall be commanded to “stop”; the Outside Air damper (OAD) and Exhaust Air damper (EAD) shall be commanded to “close”; the Return Air damper (RAD) commanded to “open”. The unit’s cooling sequences shall be disabled. The Heating Coil control valve (HTG) shall be commanded “open” to the coil. A Drip Pan Liquid Detection (LIQUID) alarm shall be sent to the GUI. The alarm shall be reset through a software switch from the GUI.

X. LOW LIMIT SWITCH (LLSTRIP) ALARM: A Low Temperature Limit Switch (LLS) shall be located on the leaving airside of the Heating Coil. If the Low Temperature Limit Switch (LLS) senses a coil discharge temperature below the local device setting of 38 °F; the Unit’s Fan (SFSS) shall be commanded to “stop”; the Outside Air damper (OAD), Exhaust Air damper (EAD) shall be commanded to “close”; the Return Air damper (RAD) commanded “open”. The Heating Coil control valve (HTG) shall “open” to the coil. The unit’s cooling sequences shall be disabled. A Low-Limit Switch Tripped (LLSTRIP) shall be sent to the GUI. The Low Temperature Limit Switch (LLS) shall be reset from the GUI.

Y. COOLING FAILURE ALARM (COOLFAIL - DAT): If the Discharge Air Temperature (DAT) remains within 4°F (adj.) of the Mixed Air Temperature (MAT) after with the cooling mode is utilized (for greater than 5 minutes). A Cooling Failure alarm (COOLFAIL) shall be sent to the GUI. This alarm shall not be enabled until the Supply Fan status (SFST) has been “on” for 10 minutes (adj.).

Z. COOLING FAILURE ALARM (COOLFAIL - RMT): If the Discharge Air Temperature (DAT) remains within 4°F (adj.) of the Space Temperature (RMT) after with the cooling mode is utilized (for greater than 5 minutes). A Cooling Failure alarm (COOLFAIL) shall be sent to the GUI. This alarm shall not be enabled until the Supply Fan status (SFST) has been “on” for 10 minutes (adj.).

AA. HEATING FAILURE ALARM (HEATFAIL - DAT): If the Discharge Air Temperature (DAT) remains within 4°F (adj.) of the Mixed Air Temperature (MAT) after of the heating signal is greater than 10% “open” (For greater than 5 minutes) This alarm shall not be enabled until the zone has been “on” for 10 minutes (adj.). A Heating Failure alarm (HEATFAIL) shall be sent to the GUI. This alarm shall not be enabled until the Supply Fan status (SFST) has been “on” for 10 minutes (adj.).

BB. HEATING FAILURE ALARM (HEATFAIL - RMT): If the Discharge Air Temperature (DAT) remains within 4°F (adj.) of the Space Temperature (RMT) after of the heating signal is greater than 10% “open” (For greater than 5 minutes) This alarm shall not be enabled until the zone has been “on” for 10 minutes (adj.). A Heating Failure alarm (HEATFAIL) shall be sent to the GUI. This alarm shall not be enabled until the Supply Fan status (SFST) has been “on” for 10 minutes (adj.).

CC. DISCHARGE AIR LOW ALARM (DATLO): If the Discharge Air Temperature (DAT) decreases below the Discharge Air Temperature Low Limit Setpoint (DALL) or 45°F (adj.), the Outside Air damper (OAD), Exhaust Air damper (EAD) shall be commanded to “close”, The Return Air damper (RAD) commanded to “open”, and an alarm (DATLO) shall be sent to the GUI. This sequence shall be disabled during any cooling mode of operation.

DD. MIXED AIR TEMPERATURE ALARM (DAMPER): If the Outside Air Temperature (OAT) is lower than the Mixed Air Temperature Setpoint (MASP), then if the Mixed Air Temperature (MAT) fails to be with 4°F of the Mixed Air Temperature Setpoint (MASP) or if the Mixed Air Temperature (MAT) is greater than 80 °F(adj.) or less than 45°F (adj.), then an alarm (DAMPER) shall be sent to the GUI.

EE. FAN FAILURE ALARM (FAIL): If a Fan (i.e., SFSS, RFSS, etc..) is commanded to “start”, but the Fan status (i.e., SFSS, RFSS, etc..) is “off”, a Fan Failure (FAIL) alarm shall be sent to the GUI.

FF. FAN IN HAND ALARM (HAND): If a Fan command (i.e., SFSS, RFSS, etc..) is commanded to “stop”, but the Fan status (i.e., SFST, RFST, etc..) is “on”, a Fan-in-Hand (HAND) alarm shall be sent to the GUI.

GG. FAN FAULT ALARM (FAULT): If the Unit’s Fan Variable Frequency Drive Fault contact (i.e., SFFLT, RFFLT, etc..) is detected, a Fan VFD Fault alarm shall be sent to the GUI.

HH. BUILDING PRESSURE ALARM (BSTATIC): When the Unit’s Relief Fan (SFSS) is commanded “on”, and the Building Static Pressure (BSP) is more than 10% from the Building Pressure Setpoint (DPSP) a Building Static Pressure alarm (BSTATIC) shall be sent to the GUI.

II. TEMPERATURE SENSOR FAILURE (SENSOR): Anytime the value of a Temperature Sensor is greater or less than the operational limitations of the sensor, a Temperature Sensor Failure alarm (SENSOR) shall be sent to the GUI.

JJ. OPERATOR INTERFACE REQUIREMENTS:

1. Input/Output Points:

AHU 1 & 3	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
BACnet Communication Interface Points	X	X	X	X	X	X	UMD
Supply Fan Start/Stop (SFSS)				O	X	X	R
Supply Fan Status (SFST)			X		X	X	CS
Supply Fan Fault (SFFLT)			X		X	X	
Supply Fan Speed (SFAO)		X			X	X	
Exhaust Fan Start/Stop (EFSS)				O	X	X	R

Exhaust Fan Status (EFST)			X		X	X	CS
Exhaust Fan Fault (EFFLT)			X		X	X	
Exhaust Fan Speed (EFAO)		X			X	X	
Direct eXpansion Cooling (CLG)		O		O	X	X	
Heating Coil control (HTG)		O		O	X	X	
Duct Static Pressure (DSP)	X				X	X	DPT
Duct Pressure Switch (DPSW)			X		L	L	DPS
Building Static Pressure (BSP)	X				X	X	DPT
Space Temperature (RMT)	X				X	X	TS-W
Space Relative Humidity (RMRH)	X				X	X	RH-W
Return Air Humidity (RAH)	X				X	X	RH-D
Discharge Air Temperature (DAT)	X				X	X	TS-D
Mixed Air Temperature (MAT)	X				X	X	TS-A
Return Air Temperature Setpoint (RAT)	X				X	X	TS-D
Outside Air Damper (OAD)		O		X	X	X	M
Return Air Damper (RAD)		O		X	X	X	M
Exhaust Air Damper (EAD)		O		X	X	X	M
Filter (FLTR)			X		X	X	DPS
Liquid Detection Sensor (LDS)			X		X	X	LDS

2. Control Parameters and Settings

AHU 1 & 3	Parameters and Settings			
Parameter Name/Description X = Display on GUI A = Adjustable	AV	Trend	GUI	Initial- Setting
BACnet Interface Parameters	A	X	X	
Occupancy Schedules (SCHED)	X	X	X	
“Occupied” Space Heating Setpoint (HSP)	A	X	X	70 °F
“Occupied” Space Cooling Setpoint (CSP)	A	X	X	72 °F
“Unoccupied” Space Heating Setpoint (UHSP)	A	X	X	65 °F
“Unoccupied” Space Cooling Setpoint (UCSP)	A	X	X	78 °F
Relative Humidity Setpoint (RHSP)	A	X	X	50 %r.h.
Discharge Air Temperature Setpoint (DASP)	A	X	X	See Sequence
Discharge Air Temperature Low Limit (DALL)	A	X	C	55°F
Mixed Air Temperature Setpoint (MASP)				See Sequence
Duct Static Pressure Setpoint (DPSP)	A	X		1.5 inches w.c.
Building Pressure Setpoint (BPSP)	A	X		0.05 inches w.c.
Space Temp “Warm-up” Setpoint (WUSP)	A	X	C	2 °F (WUSP – HSP)
Filter Replacement Timer (FILTERSP)				1000 hours
Minimum Outside Air damper (MINOA)				Set by Balancer
OA Intake CFM Setpoint (OACFMSP)	A	X	X	Set by Balancer
All Alarm Setpoints and/or Parameters	A	X	C	Alarm settings
Alarm Reset	A	X	X	

3. Alarms

AHU 1 & 3	Alarms and Conditions		
Alarm Name	Point	Normal	Alarm
BACnet Interface Alarms	Varies	Varies	Varies
Filter Maintenance (FILTER)	FLTR	OFF	ON
Space Temperature (TEMP)	RMT	< +/- 4°F SP	> +/-4°F SP
Humidity Alarm (HUMIDITY)	RMRH	<10%r.h. SP	>10%r.h. SP
Liquid Detection (LIQUID)	LDS	OFF	ON
Cooling Failure (COOLFAIL)	See Sequence of Operations		

Heating Failure (HEATFAIL)	See Sequence of Operations		
Discharge Air Temp (DATLO)	DAT	> 45 °F	< 45 °F
Mixed Air Temperature (MATLO)	MAT	See Sequence of Operations	
Fan Failure (FAIL)	#FSS #FSTS	#FSS = ON #FST = ON	#FSS = ON #FST = OFF
Fan in Hand (HAND)	#FSS #FSt	#FSS = OFF #FST = OFF	#FSS = OFF #FST = ON
Fan Fault Alarm (FAULT)	#FFLT	OFF	ON
Duct Static Pressure alarm	DSP		>+/- 10% SP
Building Static Pressure alarm	BSP		>+/- 10% SP
High Air Temperature	#AT		#AT greater than #ASP+5 °F
Low Air Temperature	#AT		#AT -5 °F less than #ASP
Temp Sensor Failure (SENSOR)	Varies	-10°F < Input Input < 220°F	-10°F > Input Input > 220°F

1.23 EXHAUST FAN EF-1 & EF-2

A. “OPTIMAL START / STOP”: The DDC controller shall go to the next scheduled setpoint based on economizer mode

B. SCHEDULING: The unit’s schedule (SCHED) is as established in the BMS GUI and shall be communicated to the Unit’s DDC controller. The unit’s DDC controller shall have a built-in timeclock.

C. “PROOF OF OPERATION”: A current switch shall monitor the Unit’s Supply fan status (SFST). The unit shall remain in “Unoccupied” until the Supply Fan status (SFST) indicates on.

D. “UNOCCUPIED”: The fans (EF-1 & EF-2) shall be commanded to “stop”. Any associated exhaust fans (EFSS) shall be commanded to “stop”; the Outside Air damper (OAD) and Exhaust Air Damper (EAD) shall be commanded to “close”; the Return dampers (RAD) shall be commanded “open”; the Direct eXpansion Cooling shall be “off”; the Heating Coil control (HTG) shall modulate be “off”.

E. “OCCUPIED”: EF-2 shall be commanded to run continuously when AHU-2 is “ON”, associated motorized damper shall “open”. EF-1 motorized damper shall “close” and EF-1 shall be commanded “OFF”. During economized mode EF-2 fan shall be commanded “OFF” and associated motorized damper shall be commanded “close” and EF-1 shall be commanded “ON” and associated motorized damper shall be commanded “open”.

F. OPERATOR INTERFACE REQUIREMENTS:

1. Input/Output Points:

EF-1 & 2	I/O Points						
Point Name/Description/Legend X = DDC I/O L = Local Control A = Adjustable O = Override	AI	AO	BI	BO	Trend	GUI	Device
BACnet Communication Interface Points	X	X	X	X	X	X	UMD
Exhaust Fan Start/Stop (EFSS)				O	X	X	R

1.24 TWO (2) SPEED EXHAUST FAN EF-4

A. COORDINATION: The Building Management System Contractor (BMSC) shall provide, field install and wire a BACnet DDC controller, sensors, relays, and status sensors. The Unit shall be provided as outlined under the equipment schedules. The Mechanical contractor (MC) shall provide coordination between the UM and the BMSC for a complete integrated system.

B. “OCCUPIED”: The exhaust fan shall be commanded to run continuously at low speed when then penthouse occupancy sensor is activated. When the penthouse occupancy sensor is not activated for 15 minutes (adj.) the exhaust fan shall be commanded to stop.

C. “REFRIGERANT LEAK DETECTION”: The exhaust fan shall be commanded to run continuously at high speed when the penthouse refrigerant leak detection system detects more than 500 ppm of refrigerant in the space. When the penthouse refrigerant leak detection system detects less than 500 ppm of refrigerant the exhaust fan shall be commanded to run continuously at low speed for 15 minutes (adj.). After 15 minutes (adj.) if the penthouse occupancy sensor is not activated the exhaust fan shall be commanded to stop.

D. Refer to specification 283500 Refrigerant Detection and Alarm for more information on the penthouse refrigerant leak detection system.

1.25 GRAPHICAL USER INTERFACE (GUI) - WORKSTATION:

A. COORDINATION: The BMSC shall provide and power a TCP/IP connected Workstation with the ability to read, adjust and override the various parameters for system control; provide each of the DDC controlled equipment with graphics with a minimum of the complete I/O point listing, their associated setpoints and any other variable for the adjustment and operation of the system.

1.26 GRAPHICAL USER INTERFACE DEMONSTRATION:

A. COORDINATION: The BMSC shall demonstrate the Graphics, trending, and communications setup to the owner prior to acceptance of the system.

B. ALARM NOTIFICATION: The BMS shall notify the Owner of an alarming condition via a Visual Alerts and Audible sounds locally at the GUI. If connected via a TCP/IP connection, an e-mail shall be sent depending on user configuration. Any maintenance worker shall be capable of interrogating the alarm using the Laptop workstation browsers (via. the internet)

1.27 SYSTEM STARTUP

A. The BMSC shall provide BMS factory trained and certified technicians to setup, check and adjust the BMS devices utilized on the project. The BMS technicians shall be experienced in the type of HVAC systems associated with this project.

1.28 SYSTEM DEMONSTRATION:

A. After the startup has been completed on the BMS, the BMSC shall provide a thorough demonstration of the Sequence of Operation for each BMS controlled system(s) to the Architect or their Representative.

1.29 TRAINING:

A. ONSITE TRAINING: After the BMS has been accepted, the BMSC shall provide 8 hours of onsite BMS training for the Owner's personnel. The onsite training shall include a field demonstration and hand-on operation of the BMS. The BMSC shall coordinate the scheduling of the training with the Owner.

1.30 SYSTEM SUPPORT

A. REMOTE SUPPORT: The Owner shall provide a secure TCP/IP connection to the BMS for the first year of the warranty period. After the BMS has been demonstrated and accepted, during the warranty period, the BMSC shall through a secure TCP/IP connection from their office connect to the BMS to assist in identifying and correcting any BMS warranty issues. The BMSC shall maintain backup copies of the BMS software, graphics, and programming.

END OF SECTION 230993

SECTION 232113 – HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Above ground hot-water heating piping.
2. Condensate-drain piping.
3. Air-vent piping.
4. Safety-valve-inlet and -outlet piping.

1.3 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot-Water Heating Piping: 175 psig at 250 deg F.
2. Condensate-Drain Piping: 150 deg F.
3. Air-Vent Piping: 200 deg F.
4. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.4 SUBMITTALS

A. Product Data: For each type of the following:

1. All types of piping including underground chilled water piping.
2. Pressure-seal fittings.
3. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
4. Air control devices.
5. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series number.

C. Welding certificates.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

G. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied from the same manufacturer as the grooved components.

1.6 EXTRA MATERIALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

E. Copper or Bronze Pressure-Seal Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

a. Stadler-Viega.

b. Approved equal

4. Housing: Copper.
5. O-Rings and Pipe Stops: EPDM.
6. Tools: Manufacturer's special tools.
7. Minimum 200-psig (1379-kPa) working-pressure rating at 250 deg F (121 deg C).

F. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

a. T-DRILL Industries Inc.

b. Approved equal

G. Wrought-Copper Unions: ASME B16.22.\

H. Grooved Copper Mechanical-Joint Couplings and Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

    a. Victaulic Company.

    b. Approved equal

4. Grooved-End Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube, ASTM B 152 wrought copper, or ASTM B 584, bronze casting. Copper tube dimensions with grooved ends designed to accept Victaulic couplings. Flaring of tube and fitting ends to IPS dimensions is not permitted.
5. Grooved-End Tube Couplings: Copper tube dimensioned, "Installation Ready" stab-on design for direct 'stab' installation onto roll grooved copper tube without prior field disassembly and no loose parts. Housings shall be cast with offsetting, angle-pattern bolt pads coated with copper-colored enamel. Gasket shall be pressure-responsive, synthetic rubber, Grade "EHP" EPDM suitable for hot water systems up to +250°F, and plated steel bolts and nuts. Victaulic Style 607 QuickVic™

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    1. Material Group: 1.1.
    2. End Connections: Butt welding.
    3. Facings: Raised face.

H. Grooved Mechanical-Joint Couplings and Fittings:

    4. 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:

5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
6. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

    a. Victaulic Company.

    b. Approved equal

7. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel fittings with grooves or shoulders constructed to accept Victaulic couplings; with nuts and bolts to secure grooved pipe and fittings.
8. Couplings: Ductile-iron housing and synthetic rubber gasket of central cavity pressure-responsive design, with nuts and bolts to secure grooved pipe and fittings.
    a. Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ASME B31.1 and B31.9.
        1) 2" through 8": "Installation Ready" stab-on design for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. Gasket shall be Grade "EHP" EPDM suitable for hot water up to +250 deg F. Victaulic Style 107H/107 QuickVic™.
        2) 10" and 12": Standard rigid coupling with Grade "E" EPDM gasket suitable for hot water up to 230 deg F. Victaulic Style 07 (Zero-Flex®).
    b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors for vibration isolation at equipment connections. Three couplings, for each connector, shall be placed in close proximity to the source of the vibration.
        1) 2" through 6": "Installation Ready" stab-on design for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. Gasket shall be Grade "EHP" EPDM suitable for hot water up to +250 deg F. Victaulic Style 177 QuickVic™.
        2) 10" and 12": Standard flexible coupling with Grade "E" EPDM gasket suitable for hot water up to 230 deg F. Victaulic Style 77.
    c. Flange Adapters: ASTM A536 ductile iron housing, flat face, designed for mating directly to ANSI Class 125, 150 and 300 flanges. Victaulic Style 741 or 743.
9 AGS Grooved Mechanical-Joint Couplings NPS 14 and Larger: Two ASTM A536 ductile-iron housing segments cast with wedge-shaped AGS key profile, lead-in chamfer and flat bolt pads for metal to metal contact. Gaskets shall be wide-width, pressure-responsive synthetic rubber (Grade "E" EPDM for hot water systems to 230°F), and plated bolts and nuts.
    a. Rigid Type: Victaulic Style W07, provides system rigidity and support and hanging in accordance with ASME B31.1 and B31.9.
    b. Flexible Type: Victaulic Style W77, allows for linear and angular movement, vibration attenuation and stress relief.
    c. Flange Adapters: ASTM A536 ductile iron casting, flat faced, designed for mating directly to ANSI Class 125 and 150 flanges. Victaulic Style W741.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

    1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. 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.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.
f. Approved equal

3. Factory-fabricated union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

D. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
d. Approved equal

3. Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.
    e. Approved equal

3. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
4. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Calpico, Inc.
    b. Lochinvar Corporation.
    c. Watts
    d. Approved equal

3. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

G. Dielectric Nipples:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Perfection Corporation; a subsidiary of American Meter Company.
    b. Sioux Chief Manufacturing Company, Inc.
    c. Watts
    d. Approved equal

3. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 230 deg F (110 deg C). Victaulic Style 47.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "Valves."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "HVAC Instrumentation and Controls."

C. Ametal® Brass Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

    a. Armstrong Pumps, Inc.
    b. Victaulic/Tour & Andersson Series 786, 787 or 78K.
    c. Bell & Gossett
    d. Approved equal

4. Body: Ametal® brass copper alloy, y-pattern, globe type.
5. Seat: Ametal® brass copper alloy.
6. End Connections: Threaded or soldered.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Multiple-turn digital readout handwheel with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig (860 kPa).
10. Maximum Operating Temperature: 250 deg F (121 deg C).
11. Coil Components: Install Series 78U union port fitting and Series 78Y strainer/ball valve combination to complete terminal hookup at coil outlet.
12. Differential Pressure Controller: Install Series 793 differential pressure controller to stabilize differential pressure and ensure stable and accurate modulating control. Ametal® brass copper alloy body, bonnet, cone and spindles, threaded ends only.

D. Ductile-Iron, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

    a. Armstrong Pumps, Inc.
    b. Victaulic/Tour & Andersson Series 788 and 789
    c. Bell & Gossett
    d. Approved equal

4. Body: Ductile iron body, globe pattern.
5. Stem Seals: EPDM O-rings.
6. Seat: Ductile iron.

7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Multiple-turn digital readout handwheel with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig (860 kPa).
11. Maximum Operating Temperature: 250 deg F (121 deg C).
12. Differential Pressure Controller: Install Series 794 differential pressure controller with 2-1/2" through 4" valves to stabilize differential pressure and ensure stable and accurate modulating control. Ductile iron body, Ametal® brass copper alloy bonnet, cone and spindles, flanged ends only.

E. Diaphragm-Operated, Pressure-Reducing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    g. Approved equal

4. Body: Bronze or brass.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: Brass.
7. Stem Seals: EPDM O-rings.
8. Diaphragm: EPT.
9. Low inlet-pressure check valve.
10. Inlet Strainer: Removable without system shutdown.
11. Valve Seat and Stem: Noncorrosive.
12. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

g. Approved equal

4. Body: Bronze or brass.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: Brass.
7. Stem Seals: EPDM O-rings.
8. Diaphragm: EPT.
9. Wetted, Internal Work Parts: Brass and rubber.
10. Inlet Strainer: Removable without system shutdown.
11. Valve Seat and Stem: Noncorrosive.
12. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

a. Flow Design Inc.
b. Griswold Controls.
c. Bell & Gossett
d. Approved equal

4. Body: Brass or ferrous metal.
5. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
6. Combination Assemblies: Include bonze or brass-alloy ball valve.
7. Identification Tag: Marked with zone identification, valve number, and flow rate.
8. Size: Same as pipe in which installed.
9. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
10. Minimum CWP Rating: 175 psig.
11. Maximum Operating Temperature: 200 deg F (93 deg C).

2.6 AIR CONTROL DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.
5. Approved equal

C. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/8 (DN 6).
6. CWP Rating: 150 psig (1035 kPa).
7. Maximum Operating Temperature: 225 deg F (107 deg C).

D. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/4 (DN 8).
6. CWP Rating: 150 psig (1035 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

2.7 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (860 kPa).

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch (20-mm) misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

C. Victaulic Style 177, 77 or W77 flexible couplings may be used in lieu of flexible connectors for vibration isolation at equipment connections. Three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration.

D. Expansion and contraction of grooved end IPS steel and roll grooved copper tubing systems shall be accommodated with loops or bends consisting of (8) Victaulic couplings, (4) 90 degree elbows, and (4) grooved end pipe spools provided in water systems up to 250 deg F in accordance with Victaulic recommendations for expansion compensation. Install Victaulic Style 150 Mover or Style 155 expansion joints in enclosures where loops or bends cannot be applied.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 3 (DN 75) and smaller, shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
2. Type L, drawn-temper copper tubing, wrought-copper or cast bronze fittings, and grooved joints.

B. Hot-water heating piping, aboveground, NPS 4 (DN 100) and larger, shall be any of the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40 steel pipe, ductile iron or carbon steel grooved end fittings and mechanical joint couplings.

C. Makeup-water piping installed aboveground shall be either of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered/brazed joints.
2. Type L, drawn-temper copper tubing, wrought-copper or cast bronze fittings, and grooved joints.

D. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

E. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K (A), annealed-temper copper tubing with soldered or flared joints.

F. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install balancing valves at each branch connection to return main.

C. Install globe type balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using [mechanically formed] tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 23 Section "Valves."

Q. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges or Victaulic couplings in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.

S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).

T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Pipe Expansion Fittings and Loops."

U. Identify piping as specified in Division 23 Section "Mechanical Identification."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports." Comply with the following requirements for maximum spacing of supports.

B. Seismic restraints are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1-1/2 (DN 40): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
4. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (10 mm).
6. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).
7. NPS 4 (DN 100): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).
8. NPS 6 (DN 150): Maximum span, 17 feet (5.2 m); minimum rod size, 1/2 inch (13 mm).

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
4. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
6. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).

F. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.

G. Victaulic Style 107, 07, and W07 rigid couplings may be used with IPS steel piping systems, which meet the support and hanging requirements of ASME B31.1 and B31.9. An adequate number of Victaulic Style 177, 77 and W77 flexible couplings shall also be used to compensate for thermal expansion/contraction of the pipe.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Grooved Joints: Install in accordance with the manufacturer's (Victaulic) guidelines and recommendations. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by Victaulic. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A Victaulic factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

J. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

K. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages."

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232116 – HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes special-duty valves and specialties for the following:

1. Above ground hot-water heating piping.

2. Air-vent piping.

3. Safety-valve-inlet and -outlet piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

2. Air-control devices.

3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label.

Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 175 psig at 250 deg F.

2. Air-Vent Piping: 200 deg F.

3. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

A. Gate, Globe, Check and Ball Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Sections.

C. General: Provide factory-fabricated hydronic specialties recommended by manufacturer for use in service indicated. Provide hydronic specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Owner’s Representative to comply with installation requirements. Provide sizes and connections which properly mate with pipe, tube and equipment connections.

D. Balancing Valves:

1. Where the Drawings indicate a balancing valve in the water piping, provide a 150 psig diaphragm packless type combination shut-off and balancing valve with the diaphragm attached to the valve stem. Valve shall be complete with a locking mechanism that can be set at a balance point, so that the valve may be opened and closed, but not opened beyond the pre-set balance point. Valve shall be furnished with an indicator, marked to show 0% to 100% of flow. Valve body shall be of cast iron or semi-steel and shall be painted with a rust-preventive epoxy or equal coating.

2. Manufacturers: Subject to compliance with requirements, manufacturers offering balancing valves which may be incorporated in the work include, but are not limited to, the following:

a. American Air Filter Co.
b. Bell & Gossett ITT; Fluid Handling Div.
c. Danfoss, Inc.

d. Griswold Controls
e. Milwaukee Valve Co., Inc.
f. Spirax Sarco.
g. Taco, Inc.
h. Or Approved Equal.

E. Balancing Cocks:

1. Provide balance cocks as shown on the Drawings, of one of the following types:

a. Threaded Ends 2" and Smaller" Class 250, bronze body, bronze plug, screwdriver operated, straight or angle pattern.
b. Soldered Ends 2" or Smaller: Class 250, bronze body, bronze plug, screwdriver operated, straight or angled pattern.

2. Manufacturers: Subject to compliance with requirements, manufacturers offering balance cocks which may be incorporated in the work include, but are not limited to the following:

a. American Air Filter Co.
b. Bell & Gossett ITT; Fluid Handling Div.
c. Danfoss, Inc.
d. Griswold Controls
e. Milwaukee Valve Co., Inc.
f. Spirax Sarco.
g. Taco, Inc.
h. Or Approved Equal.

F. Flow Control Valves:

1. Provide flow control valves pressure rated for 250 psi, containing lift check assembly which will automatically open by means of pump flow pressure, and automatically close when pump is not operating. Pressure with means to manually open in case of pump failure.

a. Threaded Ends 2-1/2" and Smaller: Cast-iron body, bronze check mechanism, screw-in bonnet, straight or angle pattern.
b. Soldered Ends 4" and Smaller: Cast-bronze body, bronze check mechanism, screw-in bonnet, straight or angle pattern.
c. Flanged Ends 2-1/2" and Larger: Cast-iron body, bronze check mechanism, screw-in bonnet, straight or angle pattern.

2. Manufacturers: Subject to compliance with requirements, manufacturers offering flow control valves which may be incorporated in the work include, but are not limited to, the following:

a. Armstrong Pumps, Inc.
b. Bell & Gossett ITT; Fluid Handling Div.
c. Dunham-Bush, Inc.
d. Taco, Inc.
e. Or Approved Equal.

G. Water Relief Valves:

1. Provide water relief valves as indicated on the Drawings, of size and capacity for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

a. Iron body with non-ferrous internal parts, ASME rated, gradually relieving not “pop” type.

2. Manufacturers: Subject to compliance with requirements, manufacturers offering water relief valves which may be incorporated in the work include, but are not limited to, the following:

a. Amtrol, Inc.
b. Bell & Gossett ITT; Fluid Handling Div.
c. Spirax Sarco.
d. Watts Regulator Co.
e. Or Approved Equal.

H. Pressure Reducing Valves:

1. Where shown on the Drawings, provide in the make-up water supply line, an iron body pressure reducing valve with brass internal parts. Reducing valve shall be provided with a strainer and a check valve to prevent back flow of water when city water pressure is less than the system pressure. Valve setting shall be as indicated on the Drawings.

2. Manufacturers: Subject to compliance with requirements, manufacturers offering reducing valves which may be incorporated in the work include, but are not limited to, the following:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett ITT; Fluid Handling Div.
d. Taco, Inc.
e. Or Approved Equal.

2.3 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering reducing valves which may be incorporated in the work include, but are not limited to, the following:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett ITT; Fluid Handling Div.
d. Taco, Inc.
e. Or Approved Equal.

2. Body: Bronze.

3. Internal Parts: Nonferrous.

4. Operator: Screwdriver or thumbscrew.

5. Inlet Connection: NPS 1/2 (DN 15).

6. Discharge Connection: NPS 1/8 (DN 6).

7. CWP Rating: 150 psig (1035 kPa).

8. Maximum Operating Temperature: 225 deg F (107 deg C).

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering reducing valves which may be incorporated in the work include, but are not limited to, the following:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett ITT; Fluid Handling Div.
d. Taco, Inc.
e. Or Approved Equal.

2. Body: Bronze or cast iron.

3. Internal Parts: Nonferrous.

4. Operator: Noncorrosive metal float.

5. Inlet Connection: NPS 1/2 (DN 15).

6. Discharge Connection: NPS 1/4 (DN 8).

7. CWP Rating: 150 psig (1035 kPa).

8. Maximum Operating Temperature: 240 deg F (116 deg C).

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install check valves at each pump discharge and elsewhere as required to control flow direction.

C. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

END OF SECTION 232116

SECTION 232300 – REFRIGERANT 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. This Section includes refrigerant piping used for air conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air Conditioning Applications: 300 psig.

2. Suction Lines for Heat Pump Applications: 535 psig.

3. Hot Gas and Liquid Lines: 535 psig.

1.4 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.

2. Solenoid valves.

3. Hot gas bypass valves.

4. Filter dryers.

5. Strainers.

6. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot.

2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Welding certificates.

D. Field quality control test reports.

E. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section, "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight through or angle pattern.

2. Diaphragm: Phosphor bronze and stainless steel with stainless steel spring.

3. Operator: Rising stem and hand wheel.

4. Seat: Nylon.

5. End Connections: Socket, union, or flanged.

6. Working Pressure Rating: 500 psig.

7. Maximum Operating Temperature: 275 deg F.

B. Packed Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.

2. Packing: Molded stem, back seating, and replaceable under pressure.

3. Operator: Rising stem.

4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.

5. Seal Cap: Forged-brass or valox hex cap.

6. End Connections: Socket, union, threaded, or flanged.

7. Working Pressure Rating: 500 psig.

8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.

2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.

3. Piston: Removable polytetrafluoroethylene seat.

4. Closing Spring: Stainless steel.

5. Manual Opening Stem: Seal cap, plated steel stem, and graphite seal.

6. End Connections: Socket, union, threaded, or flanged.

7. Maximum Opening Pressure: 0.50 psig.

8. Working Pressure Rating: 500 psig.

9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.

2. Core: Removable ball-type check valve with stainless steel spring.

3. Seat: Polytetrafluoroethylene.

4. End Connections: Copper spring.

5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.

2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.

3. Seat: Polytetrafluoroethylene.

4. End Connections: Threaded.

5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.

6. Working Pressure Rating: 400 psig.

7. Maximum Operating Temperature: 240 deg F.

8. Manual operator.

F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.

2. Piston, Closing Spring, and Seat Insert: Stainless steel.

3. Seat Disc: Polytetrafluoroethylene.

4. End Connections: Threaded.

5. Working Pressure Rating: 400 psig.

6. Maximum Operating Temperature: 240 deg F.

G. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.

2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.

3. Packing and Gaskets: Non-asbestos.

4. Capillary and Bulb: Copper tubing filled with refrigerant charge.

5. Suction Temperature: 40 deg F.

6. Superheat: Adjustable.

7. Reverse-flow option (for heat pump applications).

8. End Connections: Socket, flare, or threaded union.

9. Working Pressure Rating: 700 psig.

H. Hot Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.

1. Body, Bonnet, and Seal Cap: Ductile iron or steel.

2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.

3. Packing and Gaskets: Non-asbestos.

4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.

5. Seat: Polytetrafluoroethylene.

6. Equalizer: Internal.

7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.

8. End Connections: Socket.

9. Throttling Range: Maximum 5 psig.

10. Working Pressure Rating: 500 psig.

11. Maximum Operating Temperature: 240 deg F.

I. Moisture/Liquid Indicators:

1. Body: Forged brass.

2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.

3. Indicator: Color coded to show moisture content in ppm.

4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.

5. End Connections: Socket or flare.

6. Working Pressure Rating: 500 psig.

7. Maximum Operating Temperature: 240 deg F.

J. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted steel shell with ductile iron cover, stainless steel screws, and neoprene gaskets.

2. Filter Media: 10 micron, pleated with integral end rings; stainless steel support.

3. Desiccant Media: Activated alumina.

4. Designed for reverse flow (for heat pump applications).

5. End Connections: Socket.

6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.

7. Maximum Pressure Loss: 2 psig.

8. Working Pressure Rating: 500 psig.

9. Maximum Operating Temperature: 240 deg F.

K. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted steel shell.

2. Filter Media: 10 micron, pleated with integral end rings; stainless steel support.

3. Desiccant Media: Activated alumina.

4. Designed for reverse flow (for heat pump applications).

5. End Connections: Socket.

6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.

7. Maximum Pressure Loss: 2 psig.

8. Working Pressure Rating: 500 psig.

9. Maximum Operating Temperature: 240 deg F.

L. Receivers: Comply with ARI 495.

1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

2. Comply with UL 207; listed and labeled by an NRTL.

3. Body: Welded steel with corrosion-resistant coating.

4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.

5. End Connections: Socket or threaded.

6. Working Pressure Rating: 500 psig.

7. Maximum Operating Temperature: 275 deg F.

M. Liquid Accumulators: Comply with ARI 495.

1. Body: Welded steel with corrosion-resistant coating.

2. End Connections: Socket or threaded.

3. Working Pressure Rating: 500 psig.

4. Maximum Operating Temperature: 275 deg F.

2.3 REFRIGERANTS

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. Atofina Chemicals, Inc.

2. DuPont Company; Fluorochemicals Div.

3. Honeywell, Inc.; Genetron Refrigerants.

4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 3-1/2 and Smaller for Conventional Air Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot Gas and Liquid Lines and Suction Lines for Heat Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Safety Relief Valve Discharge Piping: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install packed-angle valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install packed-angle valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.

2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.

3. If external equalizer lines are required, make connection where it will reflect suction line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety relief valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:

1. Solenoid valves.

2. Thermostatic expansion valves.

3. Hot gas bypass valves.

4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve and in the suction line at the compressor.

L. Install receivers sized to accommodate pump-down charge.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. 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.

E. Install piping adjacent to machines to allow service and maintenance.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Refer to Division 23 Sections, "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section, "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Slope refrigerant piping as follows:

1. Install horizontal hot gas discharge piping with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.

3. Install traps and double risers to entrain oil in vertical runs.

4. Liquid lines may be installed level.

M. When brazing or soldering, remove solenoid valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Identify refrigerant piping and valves according to Division 23 Section, "Identification for HVAC Piping and Equipment."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section, "Sleeves and Sleeve Seals for HVAC Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section, "Sleeves and Sleeve Seals for HVAC Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.

2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

F. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section, "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.

2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.

2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.

3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.

4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.

5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.

2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure. Test piping in accordance with the Mechanical Code of New Jersey State.

3. Test high and low pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

a. Fill system with nitrogen to the required test pressure.

b. System shall maintain test pressure at the manifold gage throughout duration of test.

c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.

3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high and low pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set point temperature of air conditioning or chilled water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.

2. Verify that compressor oil level is correct.

3. Open compressor suction and discharge valves.

4. Open refrigerant valves except bypass valves that are used for other purposes.

5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 – METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa). Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall round spiral-seam ducts and formed fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections include the following:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

A. NUSIG: National Uniform Seismic Installation Guidelines.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

A. Shop Drawings: CAD-generated and drawn to 1/4 inch equals 1 foot. Show fabrication and installation details for metal ducts.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Duct layout indicating sizes and pressure classes.

3. Elevations of top and bottom of ducts.

4. Dimensions of main duct runs from building grid lines.

5. Fittings.

6. Reinforcement and spacing.

7. Seam and joint construction.

8. Penetrations through fire-rated and other partitions.

9. Equipment installation based on equipment being used on Project.

10. Duct accessories, including access doors and panels.

11. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.

2. Other systems installed in same space as ducts.

3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.

4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

C. Welding certificates.

D. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

C. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Ch. 3, "Duct System," for range hood ducts, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 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.

B. Transverse Joints: Select joint types and fabricate according to 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."

C. Longitudinal Seams: Select seam types and fabricate according to 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."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 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."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round 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. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round 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."

1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.

2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," 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."

2.4 SHEET METAL MATERIALS

A. 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: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.

D. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.5 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:

a. CertainTeed Corp.; Insulation Group.
b. Johns Manville International, Inc.
c. Knauf Fiber Glass GmbH.
d. Owens Corning.
e. Or approved equal.

2. Materials: ASTM C 1071; surfaces exposed to air stream shall be coated to prevent erosion of glass fibers.

a. Thickness: 2 inch.

b. Thermal Conductivity (k-Value): 0.26 at 75 deg F (0.037 at 24 deg C) mean temperature.

c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

1) Tensile Strength: Indefinitely sustain a 50-lb- (23-kg-) tensile, dead-load test perpendicular to duct wall.

2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch (3 mm) into air stream.

3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

2.6 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber-reinforced fabric.

C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

E. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.7 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.

2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electro-galvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.

3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.

3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

2.8 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.

2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Nexus Inc.
c. Ward Industries, Inc.
d. McGrill AirFlow LLC.
e. Or approved equal

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Lockformer.
c. McGrill AirFlow LLC.
d. SEMCO LLC
e. Or approved equal

2. Duct Size: Maximum 30 inches (750 mm) wide and up to 2-inch wg (500-Pa) pressure class.

3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of non-braced panel area unless ducts are lined.

2.9 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).

G. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.

2. Intervals of lined duct preceding unlined duct.

3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.

I. Terminate inner ducts with build outs attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated build outs (metal hat sections) or other build out means are optional; when used, secure build outs to duct walls with bolts, screws, rivets, or welds.

2.10 ROUND DUCT AND FITTING FABRICATION (WHERE INDICATED ON DRAWINGS)

A. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate exhaust air ducts of aluminum according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

1. Manufacturers:

a. McGill AirFlow Corporation.
b. SEMCO Incorporated.
c. Ductmate Industries, Inc.
d. Spiral Manufacturing Co.
e. Or approved equal

B. Duct Joints:

1. Ducts up to 20 Inches (500 mm) in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.

2. Ducts 21 to 72 Inches (535 to 1830 mm) in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.

3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

a. Manufacturers:

1) Ductmate Industries, Inc.

2) Lindab Inc.

3) SEMCO Incorporated.

4) McGill AirFlow Corporation.

5) Or Approved equal

C. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

D. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

E. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):

a. Ducts 3 to 36 Inches (75 to 915 mm) in Diameter: 0.034 inch (0.85 mm).

b. Ducts 37 to 50 Inches (940 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).

3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg (500 to 2500 Pa):

a. Ducts 3 to 26 Inches (75 to 660 mm) in Diameter: 0.034 inch (0.85 mm).

b. Ducts 27 to 50 Inches (685 to 1270 mm) in Diameter: 0.040 inch (1.0 mm).

4. Round Elbows 8 Inches (200 mm) and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.

5. Round Elbows 9 through 14 Inches (225 through 355 mm) in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.

6. Die-Formed Elbows for Sizes through 8 Inches (200 mm) in Diameter and All Pressures 0.040 inch (1.0 mm) thick with 2-piece welded construction.

7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.

8. Pleated Elbows for Sizes through 14 Inches (355 mm) in Diameter and Pressures through 10-Inch wg (2500 Pa): 0.022 inch (0.55 mm).

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Return Ducts (Negative Pressure): 2 inch wg.

2. Exhaust Ducts (Negative Pressure): 2-inch wg.

B. All ducts shall be galvanized steel except exhaust air duct for chemical fume hood shall be aluminum construction.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round ducts in lengths not less than 12 feet (3.7 m) unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches (300 mm), with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches (38 mm).

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories." And firestop penetration

O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

P. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

Q. Paint interiors of metal ducts, that do not have duct liner, for 24 inches (600 mm) upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.3 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.

1. For pressure classes lower than 2-inch wg (500 Pa), seal transverse joints.

B. Seal ducts before external insulation is applied.

3.4 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet (5 m) and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (500 Pa) (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (500 to 2500 Pa).

4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.7 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Create other openings to comply with duct standards.

2. Disconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers

and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4. Coils and related components.

5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts or duct accessories.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.

2. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION 233113

SECTION 233300 – AIR DUCT ACCESSORIES

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. Manual volume dampers.
2. Control dampers.
3. Flange connectors.
4. Turning vanes.
5. Flexible connectors.
6. Flexible ducts.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. 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.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Standard leakage rating, with linkage outside airstream.

2. Suitable for horizontal or vertical applications.

3. Frames:

a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.

c. Stiffen damper blades for stability.
d. Galvanized-steel, 0.064 inch (1.62 mm) thick.

5. Blade Axles: Galvanized steel.

6. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

B. Low-Leakage, Steel, Manual Volume Dampers:

1. Comply with AMCA 500-D testing for damper rating.

2. Low-leakage rating with linkage outside airstream and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

3. Suitable for horizontal or vertical applications.

4. Frames:

a. Angle shaped.
b. 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
c. Mitered and welded corners.
d. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized, roll-formed steel, 0.064 inch (1.62 mm) thick.

6. Blade Axles: Galvanized steel.

7. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Blade Seals: Neoprene.

9. Jamb Seals: Cambered aluminum.

10. Tie Bars and Brackets: Galvanized steel.

11. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

2.4 FLANGE CONNECTORS

A. Description: roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.5 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply and return systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire dampers according to UL listing.

G. Install flexible connectors to connect ducts to equipment.

H. Connect terminal units to supply ducts with maximum 6-inch lengths of flexible duct. Do not use flexible ducts to change directions.

I. Connect flexible ducts to metal ducts with [adhesive plus sheet metal screws.

J. Install duct test holes where required for testing and balancing purposes.

K. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.

3. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.

4. Inspect turning vanes for proper and secure installation.

5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233600 – AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. single-duct air terminal units.

2. Series, fan-powered air terminal units.

3. Casing liner.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of air terminal unit.

B. Shop Drawings: For air terminal units.

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. Include diagrams for power, signal, and control wiring.

4. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trane
2. Carnes
3. Price Industries
4. Envirotech
5. Turtles & Bailey
6. Or equal Approved

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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

2.3 SINGLE-DUCT AIR TERMINAL UNITS

A. Configuration: damper assembly inside unit casing with control components inside a protective metal shroud.

B. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.

C. Electric Controls: Damper actuator and thermostat.

1. Damper Actuator: 24 V, powered closed, powered open[**with microswitch to energize heating control circuit**].

2. Thermostat: Wall-mounted electric type with temperature display in Fahrenheit and Celsius, and space temperature set point.

3. Changeover Thermostat: Duct-mounted, field-adjustable, electric type reverses action of zone thermostat when air temperature reaches 70 deg F (21 deg C).

D. Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat. Control devices shall be compatible with temperature controls specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and shall have the following features:

1. Thermostat: Wall-mounted electronic type temperature sensor

2. Retain "Direct Digital Controls" Paragraph below if control components are specified with control system; delete if control components are packaged with equipment.

E. Direct Digital Controls: Single-package unitary controller and actuator specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2.4 SERIES FAN-POWERED AIR TERMINAL UNITS

A. Configuration: Volume-damper assembly and fan in series arrangement inside unit casing with control components inside a protective metal shroud **for installation above a ceiling and within a raised access floor**.

1. Designed for quiet operation.

2. Low-profile design.

B. Casing: 0.040-inch thick galvanized steel, single wall.

1. Casing Liner: Comply with requirements in "Casing Liner" Article for **fibrous-glass** duct liner.

2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.

3. Air Outlet: S-slip and drive connections.

4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.

5. Fan: Forward-curved centrifugal.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: AHRI 880 rated, **2** percent of nominal airflow at 3-inch wg inlet static pressure.

2. Damper Position: Normally **open**.

D. Velocity Sensors: Multipoint array with velocity sensors in air inlets and air outlets.

E. Motor:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

2. Type: **Electronically commutated motor**.

3. Fan-Motor Assembly Isolation: Rubber isolators.

4. Enclosure: **Totally enclosed, fan cooled**

5. Enclosure Materials: **Cast aluminum**

6. Efficiency: Premium efficient.

   a. Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.

7. Electrical Characteristics:

   a. Refer the Schedules

F. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Material: Polyurethane foam having 70 percent arrestance and 3 MERV.

2. Material: Glass fiber treated with adhesive; having 80 percent arrestance and 5 MERV.

3. Material: Pleated cotton-polyester media having 90 percent arrestance and 7 MERV.

4. Thickness**: 1 inch.**

G. Attenuator Section: 0.034-inch aluminum sheet.

1. Attenuator Section Liner: Comply with requirements in "Casing Liner" Article for fibrous-glass duct liner.

2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

H. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

I. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.

2. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.

3. Disconnect Switch: Factory-mounted, fuse type.

J. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

K. Control devices shall be compatible with temperature controls system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

1. Electric Damper Actuator: 24 V, powered open, **spring** return.

2. Electronic Damper Actuator: 24 V, powered open, **spring** return.

3. Electric Thermostat: Wall-mounted electronic type with clock display, temperature display in Fahrenheit and Celsius, and space temperature set point.

4. Electronic Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.

5. Electronic Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg ; and shall have a multipoint velocity sensor at air inlet.

6. Terminal Unit Controller: Pressure-independent, VAV controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:

L. Control Sequence:

1. Occupied (Primary Airflow On):

a. Operate as throttling control for cooling.

b. As cooling requirement decreases, control valve throttles toward minimum airflow.

c. As heating requirement increases, fan energizes to draw in warm plenum air and the hot-water coil valve is opened.

2. Unoccupied (Primary Airflow Off):

a. When externally initiated, begin the morning warm-up/cool-down function. Damper drives to the fully open position without regard for the preset maximum.

b. When pressure at primary inlet is zero or less, fan is de-energized.

c. As heating requirement increases, fan energizes to draw in warm plenum air and the hot-water coil valve is opened.

2.5 CASING LINER

A. Casing Liner: Fibrous-glass duct liner, complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Minimum Thickness: 3/4 inch.

a. Maximum Thermal Conductivity:

1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

3. **Water**-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. Adhesive VOC Content: 80 g/L or less.

b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Casing Liner: Flexible elastomeric duct liner fabricated of preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Minimum Thickness: 3/4 inch.

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

a. Adhesive VOC Content: 50 g/L or less.

b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to AHRI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, [**coil type,**]and AHRI certification seal.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 5, "Hangers and Supports" and with Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

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 and for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.

5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. 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.

3.2 TERMINAL UNIT INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

D. Where installing piping adjacent to air terminal unit, allow space for service and maintenance.

E. Hot-Water Piping: Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties," and connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

F. Comply with requirements in Section 233113 “Metal Ducts” for connecting ducts to air terminal units.

G. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

H. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.

2. Leak Test: After installation, fill water coils 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.

B. Air terminal unit will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

SECTION 238126 – SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes split-DX/Hot Water and air conditioning units.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

C. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

1.5 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 7 Section "Roof Accessories."

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set of filters for each unit.

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daikin Applied
2. Trane
3. Aaon
4. Or Approved Equal.

2.2 UNITS

A. System Description: The Air Conditioner system shall be a Trane split system with Variable Speed Inverter Compressor technology. The system shall consist of a horizontal discharge, three phase outdoor unit. **Refer the drawings and mechanical schedules for types of models of units.**

B. Split AHU unit shall be to be knock down type to be reassembled inside mechanical rooms. Re-assembling of the unit shall be provided by the manufacturer.

C. Quality Assurance:

1. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.

2. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.

3. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the ARI Certification label.

4. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

5. A dry air holding charge shall be provided in the indoor section.

6. The outdoor unit shall be pre-charged with R-410a refrigerant for 70 feet (20 meters) of refrigerant tubing.

7. System efficiency shall meet or exceed SEER values as scheduled on the plans.

D. Delivery, Storage and Handling:

1. Unit shall be stored and handled according to the manufacturer's recommendations.

2. The controller shall be shipped separately and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

E. Warranty:

1. The units shall have a manufacturer's parts and defects warranty for a period five (5) year from date of installation. The compressor shall have a warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

2. Manufacturer shall have over thirty (30) years of continuous experience in the U.S. market.

F. Outdoor Unit Design:

1. The outdoor unit shall be equipped with an electronic control board that interfaces with the indoor unit to perform all necessary operation functions.

2. The outdoor unit shall be able to operate with a maximum height difference of 100 feet between indoor and outdoor units.

3. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.

4. Outdoor unit sound level shall not exceed 48dB (A).

G. Cabinet:

1. The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection.

2. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability.

3. Easy access shall be afforded to all serviceable parts by means of removable panel sections.

5. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

H. Fan:

1. Each unit shall be furnished with an ECM fan motor.

2. The fan blade(s) shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated.

3. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts.

I. Coil:

1. The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.

2. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be controlled by a microprocessor-controlled step motor.

3. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1” thick insulation shall have a - Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.

J. Compressor:

1. The compressor shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology.

2. The outdoor unit shall have an accumulator and high-pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

K. Electrical:

1. The electrical power of the unit shall be 208volts, single phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.

2. Power for the indoor unit shall be supplied from the outdoor unit via Mitsubishi Electric A-Control using three (3) fourteen (14) gauge AWG conductors plus ground wire connecting the units.

3. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.

4. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

L. Operating Range:

1. The Cooling Operating Temperature Range shall be 0°F to 118°F.

2. The Heating Operating Temperature Range shall be -4°F to 78°F.

M. Enclosure: **Wall mounted condensing unit to be provided with an outdoor enclosure manufactured by Property Armor.**

1. Frame: 1.5" x 1.5" x 1/8" Steel Angle Iron Base Flange 1.5" with ½" Anchor holes.

2. Center and Top Reinforcement Band: ¾" #13 Flat extended metal

3. Finish: Power coated Black 044/88888

4. Construction: MIG Welded filet .035 E71T-GS A5.20

5. Hinge Mechanism: Lock Housing 4" RD x ¼" – Accepts Puck Lock Hinge Pins ½" Round Stock / Barrels ½" RD.

N. Unit Cabinet:

1. The cabinet shall be formed from high strength molded plastic with smooth finish, flat front panel design with access for filter.

O. Fan:

1. The indoor unit fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of VFD. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

O. Filter:

1. Return air shall be filtered by means of an easily removable MERV13.

Q. Coil:

1. The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be

pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

R. Electrical:

1. The electrical power of the unit shall be 208 volts, 3 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.

S. Performance:

1. Each system shall perform in accordance to the ratings shown in the manufacturer catalog. Cooling performance shall be based on 80°F DB, 67°F WB (26.7°C DB, 19.4°C WB) for the indoor unit and 95°F DB, 75°F WB (35°C DB, 29.3°C WB) for the outdoor unit.

T. Remote Controllers: All remote controllers need to be ordered separately from the unit. Provide remote controllers as called out on the drawings and mechanical schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units' level and plumb.

B. Install in-door units using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounting outdoor units on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.

D. Install seismic restraints.

E. Install outdoor units on restrained, spring isolators with a minimum static deflection of 1 inch.

F. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding."

D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 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.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 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.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 1 Section "Closeout Procedures / Demonstration and Training."

END OF SECTION 238126

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Raceways.
   2. Building wire and connectors.
   3. Supporting devices for electrical components.
   4. Electrical identification.
   5. Electricity-metering components.
   6. Electrical demolition.
   7. Cutting and patching for electrical construction.
   8. Touchup painting.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For electricity-metering equipment.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with existing building features and arrange in building structure during progress of HVAC construction to facilitate the electrical installations that follow.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment with mechanical contractor.

C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

E. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.

B. FMC: Zinc-coated steel.

C. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.

D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.

E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.

F. Raceway Fittings: Specifically designed for the raceway type with which used.

2.02 CONDUCTORS

A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.

B. Conductors, Larger Than No. 10 AWG: Stranded copper.

C. Insulation: Thermoplastic, rated at 90 deg C minimum.

D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.03 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch-diameter slotted holes at a maximum of 2 inches o.c., in webs.

D. Slotted-Steel Channel Supports:

1. Channel Thickness: Selected to suit structural loading.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

E. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least one surface.

1. Fittings and Accessories: Products of the same manufacturer as channels and angles.
2. Fittings and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.

F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

G. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

H. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

I. Expansion Anchors: Carbon-steel wedge or sleeve type.

J. Toggle Bolts: All-steel springhead type.

K. Powder-Driven Threaded Studs: Heat-treated steel.

2.04 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
3. Color: Black letters on orange background.
4. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.

D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend that indicates type of underground line.

E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.

H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch, galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch grommets in corners for mounting.

J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.05 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.01 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02 RACEWAY APPLICATION

A. Use the following raceways for outdoor installations:

1. Exposed: IMC.
2. Concealed: IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment: LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Use the following raceways for indoor installations:

1. Exposed: EMT.
2. Concealed: EMT.
3. Connection to Vibrating Equipment: FMC; except in wet or damp locations, use LFMC.
4. Damp or Wet Locations: IMC.
5. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.03 RACEWAY AND CABLE INSTALLATION

A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

B. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

C. Use temporary raceway caps to prevent foreign matter from entering.

D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

F. Install raceways embedded in slabs in middle third of 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 concrete.
3. Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

G. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.

H. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

3.04 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

A. Feeders: Metal-clad cable.

B. Underground Feeders and Branch Circuits: Type THWN

C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.

D. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Metal-clad cable where concealed in ceilings and gypsum board partitions.

E. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.05 WIRING INSTALLATION

A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

B. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.

C. Connect outlet and component connections to wiring systems and to ground. 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.

3.06 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.07 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch- diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.

5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.

a. Field Welding: Comply with AWS D1.1.

7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.08 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and cables with color banding as follows:

1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
3. Colors: As follows:

a. Fire Alarm System: Red.
b. Security System: Blue and yellow.
c. Telecommunication System: Green and yellow.

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Black.
2. Phase B: Red.
3. Phase C: Blue.

G. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Yellow.
2. Phase B: Brown.
3. Phase C: Orange.

H. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

I. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.09 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove demolished material from Project site.

E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.10 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.11 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete bases.
7. Electrical demolition.
8. Cutting and patching for electrical construction.
9. Touchup painting.

3.12 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint.

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.13 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 260500

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND 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 the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.5 PRODUCT DELIVERY

A. Mark and tag insulated conductors and cables for delivery to site. Include the following:

1. Contractor’s name.
2. Project title and number.
3. Date of manufacture (month & year).
4. Manufacturer’s name.
5. Data which explains the meaning of coded identification (UL assigned electrical reference numbers, UL assigned combination of color marker threads, etc.).
6. Environmental suitability information (listed or marked “sunlight resistant” where exposed to direct rays of sun; wet locations listed/marked for use in wet locations; other applications listed/marked suitable for the applications).

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.7 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONDUCTORS AND CABLES

A. Manufacturers

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Pirelli Cable Corp
5. Senator Wire & Cable Company.
6. Southwire Company.
7. Or Approved Equal.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW, USE and SO.

D. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC; metal-clad cable, Type MC; mineral-insulated, metal-sheathed cable, Type MI; Type SO and Type USE with ground wire.

E. Electric Light and Power Wiring:
   a. General: Rated 600V, NFPA 70 Type THHN/THWN-2 or XHHW-2.
   b. THHN/THWN-2 Gasoline and Oil Resistant: Polyvinylchloride insulation rated 600 V with nylon jacket conforming to UL requirements for type THHN/THWN-2 insulation, with the words “GASOLINE AND OIL RESISTANT II” marked thereon.
   c. USE-2: Dual rated heat and moisture resistant insulation rated 600 V with jacket or dual-purpose insulation/protective covering conforming to UL requirements for type USE-2 service entrance cables.
   d. Metal-Clad Cable, NFPA 70 Article 330 Type MC:
      1) Interlocked flexible galvanized steel armor sheath, conforming to UL requirements for type MC metal clad cable.

2) Insulated copper conductors, suitable for 600 volts, rated 90°C, one of the types listed in NFPA 70 Table 310.13(A) or of a type identified for use in Type MC cable.
3) Internal full-size copper ground conductor with green insulation.
4) Acceptable Companies: AFC Cable Systems Inc., Southwire, General Cable.
5) Connectors for MC cable: AFC Fitting Inc.'s AFC Series, Arlington Industries Inc.'s Saddle grip, or Thomas & Betts Co.'s Tite-Bite with anti-short bushings.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. Illsco Corp
4. O-Z/Gedney; EGS Electrical Group LLC.
5. Penn Union
6. 3M; Electrical Products Division.
7. Tyco Electronics Corp.
8. Thomas & Betts
9. Or Approved Equal.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.4 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.5 SLEEVE SEALS

A. Manufacturers:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.
5. Or Approved Equal.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Plastic. Include two (2) for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 CONNECTORS

1. Connectors specified are part of a system. Furnish connectors and components, and use specific tools and methods as recommended by connector manufacturer to form complete nnector system.
2. Connectors shall be UL 486 A listed, or UL 486 B listed for combination dual rated copper/aluminum connectors (marked AL7CU for 75 degrees C rated circuits and AL9CU for 90 degrees C rated circuits).
3. Spring Type:
   a. Rated 105° C, 600V; Buchanan/Ideal Industries Inc.'s B-Cap, Electrical Products Div./3M's Scotchlok Type Y, R, G, B, O/B+, R/Y+, or B/G+, Ideal Industries Inc.'s Wing Nuts or Wire Nuts or approved equal.
   b. Rated 150° C, 600V; Ideal Industries Inc.'s High Temperature Wire-Nut Model 73B, 59B.
4. Indent Type with Insulating Jacket:
   a. Rated 105° C, 600V; Buchanan/Ideal Industries Inc.'s Crimp Connectors, Ideal Industries Inc.'s Crimp Connectors, Penn-Union Corp.'s Penn-Crimps, or Thomas & Betts Corp.'s STA-KON or approved equal.
5. Indent Type (Uninsulated): Anderson/Hubbell's Versa-Crimp, VERSAtile, Blackburn/T&B Corp.'s Color-Coded Compression Connectors, Electrical Products Div./3M's Scotchlok 10000, 11000 Series, Burndy's Hydent, Penn-Union Corp.'s BCU, BBCU Series, or Thomas & Betts Corp.'s Compression Connectors or approved equal.
6. Connector Blocks: NIS Industires Inc.'s Polaris System, or Thomas & Betts Corp.'s Blackburn AMT Series or approved equal.
7. Resin Splice Kits: Electrical Products Div./3M's Scotchcast Brand Kit Nos. 82A Series, 82-B1 or 90-B1, or Scotchcast Brand Resin Pressure Splicing Method or approved equal.
8. Heat Shrinkable Splices: Electrical Products Div./3M's ITCSN, Raychem Corp.'s Thermofit Type WCS, or Thomas & Betts Corp.'s SHRINK-KON Insulators or approved equal.
9. Cold Shrink Splices: Electrical Products Div./3M's 8420 Series or approved equal.
10. Single Cable (Compression Type Lugs): Copper, one or 2 hole style (to suit conditions), long barrel; Anderson/Hubbell's VERSAtile VHCL, Blackburn/T&B Corp.'s Color-Coded CTL, LCN, Burndy's Hylug YA, Electrical Products Div./3M Scotchlok 31036 or 31145 Series, Ideal Industries Inc.'s CCB or CCBL, NSI Industries Inc.'s L, LN Series, Penn-Union Corp.'s BBLU Series, or Thomas & Betts Corp.'s 54930BE or 54850BE Series or approved equal.
11. Single Cable (Mechanical Type Lugs): Copper, one or 2 hole style (to suit conditions); Blackburn/T&B Corp.'s Color-Keyed Locktite Series, Burndy's Qiklug Series, NSI Industries Inc.'s Type TL, Penn-Union Corp.'s VI-TITE Terminal Lug Series, or Thomas & Betts Corp.'s Locktite Series or approved equal.
12. Multiple Cable (Mechanical Type Lugs): Copper, configuration to suit conditions; Burndy's Qiklug Series, NSI Industries Inc.'s Type TL, Penn-Union Corp.'s VI-TITE Terminal Lug Series, or Thomas & Betts Corp.'s Color-Keyed Locktite Series or approved equal.

2.5 TAPES

A. Plastic Tape: Electrical Products Div./3M's Scotch Super 33+ or Scotch 88, Plymouth Rubber Co.'s Plymouth/ Bishop Premium 85CW or approved equal.

B. Rubber Tape: Electrical Products Div./3M's Scotch 130C, or Plymouth Rubber Co.'s Plymouth/Bishop W963 Plysafe or approved equal.

C. Moisture Sealing Tape: Electrical Products Div./3M's Scotch 2200 or 2210, or Plymouth Rubber Co.'s Plymouth/Bishop 4000 Plyseal-V.

D. Electrical Filler Tape: Electrical Products Div./3M's Scotchfil, or Plymouth Rubber Co.'s Plymouth/Bishop 125 Electrical Filler Tape.

E. Arc Proofing Tapes:

1. Arc Proofing Tape: Electrical Products Div./3M's Scotch 77, Mac Products Inc.'s AP Series, or Plymouth Rubber Co.'s Plymouth/Bishop 53 Plyarc or approved equal.

2. Glass Cloth Tape: Electrical Products Div./3M's Scotch 27/Scotch 69, Mac Products Inc.'s TAPGLA 5066, or Plymouth Rubber Co.'s Plymouth/Bishop 77 Plyglas or approved equal.

3. Glass-Fiber Cord: Mac Products Inc's MAC 0527 or approved equal.

2.6 TAGS

1. Phenolic: Two color laminated engraver's stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).

2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.

2.7 WIRE MANAGEMENT PRODUCTS

A. Clamps and Clips, Cable Ties, Spiral Wraps, Etc: Catamount/T&B Corp., or Ideal Industries Inc. or approved equal.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN or Type XHHW, single conductors in raceway .

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway;; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway; Armored cable, Type AC; Metal-clad cable, Type MC or Mineral-insulated, metal-sheathed cable, Type MI.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. 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 raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

A. 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.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

   a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
   b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

3.7 INSTALLATION

A. conductors in raceways after the raceway system is completed. Exceptions: Type MC, MI, or other type specifically indicated on the drawings not to be installed in raceways.

B. No grease, oil, or lubricant other than wire-pulling compounds specified may be used to facilitate the installation of conductors.

3.8 CIRCUITING

A. Do not change, group or combine circuits other than as indicated on the drawings.

3.9 COMMON NEUTRAL CONDUCTOR

A. A common neutral may be used for 2 or 3 branch circuits where the circuits are indicated on the drawings to be enclosed within the same raceway, provided each branch circuit is connected to different phase busses in the panelboard.

B. Exceptions - The following circuits shall have a separate neutral:

1. Circuits containing ground fault circuit interrupter devices.
2. Circuits containing solid state dimmers.
3. Circuits recommended by equipment manufacturers to have separate neutrals.

3.10 CONDUCTOR SIZE

A. Conductor Size:

1. For Electric Light and Power Branch Circuits: Install conductors of size shown on drawings. Where size is not indicated, the minimum size allowed is No. 12 AWG.
2. For Class 1 Circuits:
   a. No. 18 and No. 16 AWG may be used provided they supply loads that do not exceed 6 amps (No. 18 AWG), or 8 amps (No. 16 AWG).
   b. Larger than No. 16 AWG: Use to supply loads not greater than the ampacities given in NFPA 70 Section 310.15.
3. For Class 2 Circuits: Any size to suit application.
4. For Class 3 Circuits: Minimum No. 18 AWG.

3.11 COLOR CODING

A. Color Coding for 120/208 Volt Electric Light and Power Wiring:

1. Color Code:
   a. 2 wire circuit - black, white.
   b. 3 wire circuit - black, red, white.
   c. 4 wire circuit - black, red, blue, white.
2. White to be used only for an insulated grounded conductor (neutral). If neutral is not required use black and red, or black, red and blue for phase to phase circuits.
   a. “White” for Sizes No. 6 AWG or Smaller:
      1) Continuous white outer finish, or:
      2) Three continuous white stripes on other than green insulation along its continuous length.
   b. “White” for Sizes Larger Than No. 6 AWG:
      1) Continuous white outer finish, or:
      2) Three continuous white stripes on other than green insulation along its continuous length, or:
      3) Distinctive white markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install white color coding tape at terminations, and at 1’ 0” intervals in gutters, pullboxes, and manholes.
3. Colors (Black, Red, Blue):
   a. For Branch Circuits: Continuous color outer finish.
   b. For Feeders:
      1) Continuous color outer finish, or:

2) Color coding tapes encircling the conductors, installed on the conductors at time of their installation. Install color coding tapes at terminations, and at 1' 0" intervals in gutter, pullboxes, and manholes.

B. Color Coding For 277/480 Volt Electric Light and Power Wiring:

1. Color Code:
   a. 2 wire circuit – brown, gray.
   b. 3 wire circuit – brown, yellow, gray.
   c. 4 wire circuit – brown, yellow, orange, gray.
2. Gray to be used only for an insulated grounded conductor (neutral). If neutral is not required use brown and yellow, or brown, yellow and orange for phase to phase circuits.
   a. "Gray" For Sizes No. 6 AWG or Smaller.
      1) Continuous gray outer finish.
   b. "Gray" For Sizes Larger Than No. 6 AWG:
      1) Distinctive gray markings (color coding tape) encircling the conductor, installed on the conductor at time of its installation. Install gray color coding tape at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.
   c. Colors (Brown, Yellow, Orange):
   d. For Branch Circuits: Continuous color outer finish.
   e. For Feeders:
      1) Continuous color outer finish, or:
      2) Color coding tapes encircling the conductors, installed on the conductors at the time of their installation. Install color coding tapes at terminations, and at 1' 0" intervals in gutters, pullboxes, and manholes.

C. More Than One Nominal Voltage System Within A building: Permanently post the color coding scheme at each branch-circuit panelboard.

D. Existing Color Coding Scheme: Where an existing color coding scheme is in use, match the existing color coding if it is in accordance with the requirements of NFPA 70.

E. Color Code For Wiring Other Than Electric Light and Power: In accordance with ICEA standard S-73-532 (NEMA WC57-2004). Other coding methods may be used, as approved.

3.12 IDENTIFICATION

A. Identification Tags: Use tags to identify feeders and designated circuits. Install tags so that they are easily read without moving adjacent feeders or requiring removal of arc proofing tapes. Attach tags with non-ferrous wire or brass chain.

1. Interior Feeders: Identify each feeder in pullboxes and gutters. Identify by feeder number and size.
2. Exterior Feeders: Identify each feeder in manholes and in interior pullboxes and gutters. Identify by feeder number and size, and also indicate building number and panel designation from which feeder originates.
3. Street and Grounds Lighting Circuits: Identify each circuit in manholes and lighting standard bases. Identify by circuit number and size, and also indicate building number and panel designation from which circuit originates.

B. Identification Plaque: Where a building or structure is supplied by more than one service, or has any combination of feeders, branch circuits, or services passing through it, install a permanent plaque or directory at each service, feeder and branch circuit disconnect location denoting all other services,

feeders, or branch circuits supplying that building or structure or passing through that building or structure and the area served by each.

3.13 WIRE MANAGEMENT

A. Use wire management products to bundle, route, and support wiring in junction boxes, pullboxes, wireways, gutters, channels, and other locations where wiring is accessible.

3.14 EQUIPMENT GROUNDING CONDUCTOR

A. Install equipment grounding conductor:
   1. Where specified in other Sections or indicated on the drawings.
   2. In conjunction with circuits recommended by equipment manufacturers to have equipment grounding conductor.

B. Equipment grounding conductor is not intended as a current carrying conductor under normal operating circumstances.

C. Color Coding For Equipment Grounding Conductor:
   1. Color Code: Green.
   2. “Green” For sizes No. 6 AWG or Smaller:
      a. Continuous green outer finish, or:
      b. Continuous green outer finish with one or more yellow stripes, or:
      c. Bare copper (see exception below).
   3. “Green” For Sizes Larger Than No. 6:
      a. Stripping the insulation or covering from the entire exposed length (see exception below).
      b. Marking the exposed insulation or covering with green color coding tapes.
      c. Identify at each end and at every point where the equipment grounding conductor is accessible.
   4. Exception For use of Bare Copper: Not allowed for use where NFPA 70 specifically requires equipment grounding conductor to be insulated, or where specified in other Sections or indicated on the drawings to be insulated.

3.15 ARC PROOFING

A. Where indicted on the drawings, arc proof feeders installed in a common pullbox or manhole as follows:
   1. Arc proof new feeders.
   2. Arc proof existing feeders that are spliced to new feeders.
   3. Arc proof each feeder as a unit (except feeders consisting of multiple sets of conductors).
   4. Arc proof feeders consisting of multiple sets of conductors by arc proofing each set of conductors as a unit.
   5. Arc proof feeders with half-lapped layer of 55 mils thick arc proofing tape and random wrapped or laced with glass cloth tape or glass-fiber cord. For arc proofing tape less than 55 mils thick, add layers to equivalent of 55 mils thick arc proofing tape.

3.16 INSULATED CONDUCTOR AND CABLE SCHEDULE - TYPES AND USE

A. Electric Light and Power Circuits:

1. Type THHN/THWN-2 or XHHW-2. : Wiring in dry or damp locations (except where special type insulation is required).
2. THHN/THWN-2 or XHHW-2: Wiring in wet locations.
3. THHN/THWN-2: Wiring installed in existing raceway systems (except where special type insulation is required).
4. THHN/THWN-2 or XHHW-2: Wiring for electric discharge lighting circuits (fluorescent, HID), except where fixture listing requires wiring rated higher than 90° C.
5. THHN/THWN-2 Marked “Gasoline and Oil Resistant”: Wiring to gasoline and fuel oil pumps.
6. MC:
   a. Branch circuit wiring in wood framed construction (wood joists and wood stud partitions):
      1) Install conductors parallel with joists or studs and attach to the side of these timbers by galvanized straps spaced not more than 6 feet apart.
      2) Install conductors through holes bored in the center of the timbers when running at right angles to joists or studs.
      3) Do not attach the conductors to the edge of joists or studs.
   b. Branch circuit wiring in movable metal partitions and movable gypsum partitions.
      1) Install conductors in accordance with partition manufacturer’s recommendations.
   c. Branch circuit wiring in metal stud partitions:
      1) Install conductors parallel with studs and attach to the side by galvanized straps spaced not more than 6 feet apart.
      2) Install conductors through holes bored in the center of the metal member when running at right angles to studs.
         a) Conductors shall be protected by listed bushings or listed grommets covering all metal edges.

B. Emergency Feeder Circuits: Use electrical circuit protective system.

C. Class 1 Circuits: Use Class 1 wiring specified in Part 2 (except where special type insulation is required).

D. Class 2 Circuits: Use Class 2 wiring specified in Part 2 (except where special type insulation is required).

E. Class 3 Circuits: Use Class 3 wiring specified in Part 2 (except where special type insulation is required).

3.17 CONNECTOR SCHEDULE - TYPES AND USE

A. Temperature Rating: Use connectors that have a temperature rating, equal to, or greater than the temperature rating of the conductors to which they are connected.

B. Splices:

1. Dry Locations:
   a. For Conductors No. 8 AWG or Smaller: Use spring type pressure connectors, indent type pressure connectors with insulating jackets, or connector blocks (except where special type splices are required).
   b. For Conductors No. 6 AWG or Larger: Use connector blocks or uninsulated indent type pressure connectors. Fill indentions in uninsulated connectors with electrical filler tape and apply insulation tape to insulation equivalent of the conductor, or insulate with heat shrinkable splices or cold shrink splices.

c. Gutter Taps in Panelboards: For uninsulated type gutter taps fill indentions with electrical filler tape and apply insulation tape to insulation equivalent of the conductor, or insulate with gutter tap cover.

2. Damp Locations: As specified for dry locations, except apply moisture sealing tape over the entire insulated connection (moisture sealing tape not required if heat shrinkable splices or cold shrink splices are used).

3. Wet Locations: Use uninsulated indent type pressure connectors and insulate with resin splice kits, cold shrink splices or heat shrinkable splices. Exception: Splices above ground which are totally enclosed and protected in NEMA 3R, 4, 4X enclosures may be spliced as specified for damp locations.

C. Terminations:

1. For Conductors No. 10 AWG or Smaller: Use terminals for:
   a. Connecting wiring to equipment designed for use with terminals.

2. For Conductors No. 8 AWG or Larger: Use compression or mechanical type lugs for:
   a. Connecting cables to flat bus bars.
   b. Connecting cables to equipment designed for use with lugs.

3. For Conductor Sizes Larger Than Terminal Capacity On Equipment: Reduce the larger conductor to the maximum conductor size that terminal can accommodate (reduced section not longer than one foot). Use compression or mechanical type connectors suitable for reducing connection.

END OF SECTION 260519

SECTION 260523 – CONTROL-VOLTAGE ELECTRICAL POWER 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. Section Includes:

1. Low-voltage control cabling.

2. Control-circuit conductors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Source quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 450 or less.

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.

PART 2 - PRODUCTS

2.1 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry."

2.2 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway or power-limited cable, concealed in building finishes, complying with UL 83.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

B. Install manufactured conduit sweeps if possible.

C. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets and terminals.

2. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, and terminals.

3. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii.

4. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

5. Pulling Cable: Monitor cable pull tensions.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

D. Open-Cable Installation:

1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.

2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

3.3 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables made obsolete by this contract.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No 14 AWG.

2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.

3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.6 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and labeling of all components.

END OF SECTION 260523

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Ground rods.

2. Grounding arrangements and connections for separately derived systems.

3. Grounding for sensitive electronic equipment.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells grounding connections for separately derived systems based on NETA MTS.

a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.

b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. 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) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ground Clamps (Cable to Pipe): Blackburn/T&B Corp.'s GUV, Burndy's GAR, GD, GP, GK, or OZ/Gedney Co.'s ABG, CG or approved equal.

B. Ground Clamps (Cable to Rod): Blackburn/T&B Corp.'s GG, GGH, JAB, GUV, Burndy's GP, GX, GRC, or OZ/Gedney Co.'s ABG or approved equal.

C. Ground Lugs: Copper, one or 2 hole style (to suit conditions), long barrel; Anderson/Hubbell's VERSAtile VHCL, Blackburn/T&B Corp.'s Color-Coded CTL, LCN, Burndy's Hylug YA, 3M Scotchlok 31036 or 31145 Series, or Thomas & Betts Corp.'s 54930BE or 54850BE Series or approved equal.

D. Exothermic Type Weld: Erico Inc.'s Cadweld Process, or Furseweld/T&B Corp.'s Exothermic Welding System or approved equal.

E. Compression Connectors: Amp Inc.'s Ampact Copper Grounding System, or Burndy's Hyground System or approved equal.

F. Rod Electrodes: Copper clad (minimum .010 jacket) ground rods minimum 5/8 inches diameter by 8'-0" long.

G. Plate Electrodes: Copper plates minimum 0.06 inches thick by 2'-0" square feet of surface area.

H. Grounding Electrode Conductors and Bonding Conductors: Copper conductors, bare or insulated with THW, THW-2, XHHW, XHHW-2, THWN, THWN-2 or THHN insulation.

I. Hardware: Silicon-bronze bolts, nuts, flat and lock washers etc. as manufactured by Burndy, or OZ/Gedney Co. or approved equal.

2.2 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.

2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.3 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 by 96 inches minimum in diameter. Chemical-Enhanced Grounding Electrodes shall not be used.

B. Building steel.

C. Underground water pipe.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded

conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.

2. Lighting circuits.

3. Receptacle circuits.

4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.

6. Flexible raceway runs.

7. Armored and metal-clad cable runs.

8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters,

dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide 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.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors 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, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 75 feet apart.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance not less than two full days after last trace of precipitation and without 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.

   b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.

3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 26 Section "Vibration and Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.

2. Steel slotted channel systems. Include Product Data for components.

3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers:

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.; a division of Cooper Industries.

c. ERICO International Corporation.

d. GS Metals Corp.

e. Thomas & Betts Corporation.

f. Unistrut; Tyco International, Ltd.

g. Wesanco, Inc.

h. Or Approved Equal.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

5. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Manufacturers:

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.; a division of Cooper Industries.

c. Fabco Plastics Wholesale Limited.

d. Seasafe, Inc.

e. Or Approved Equal.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.

3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.

4. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers:

1) Cooper B-Line, Inc.; a division of Cooper Industries.

2) Empire Tool and Manufacturing Co., Inc.

3) Hilti Inc.

4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5) MKT Fastening, LLC.

6) Or Approved Equal.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

5. Toggle Bolts: All-steel springhead type.

6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports where permitted by signed ands sealed shop drawings.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70 where permitted by signed ands sealed shop drawings.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.

6. To Light Steel: Sheet metal screws.

7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. NBR: Acrylonitrile-butadiene rubber.

G. RNC: Rigid nonmetallic conduit.

1.3 MATERIALS

A. Metal Conduits and Fittings:

1. GRC.
2. ARC.
3. PVC-coated rigid steel conduit].
4. EMT.
5. FMC: Zinc-coated steel.
6. LFMC.
7. Fittings:
   a. Conduit fittings for hazardous (classified) locations.
   b. EMT: Steel type. Provide compression coupling up to 1-1/4 inch and setscrew 1-1/2 inch and larger.
   c. Expansion fittings.
   d. PVC coated.

B. Nonmetallic Conduit and Fittings:

1. ENT.

2. RNC.
3. LFNC.
4. HDPE.
5. Fittings: Match conduit.

C. Metal Wireways and Auxiliary Gutters: Sheet metal with [screw-cover type for indoor and Flanged-and-gasketed type for outdoors unless otherwise indicated.

D. Nonmetallic Wireways and Auxiliary Gutters: PVC plastic.

E. Surface Metal Raceways: Metal, galvanized steel, with snap-on covers.

F. Surface Nonmetallic Raceways: Two- or three-piece, rigid PVC.

G. Boxes, Enclosures, and Cabinets:

1. Metal Outlet and Device Boxes: Aluminum.
2. Nonmetallic outlet and device boxes.
3. Metal Floor Boxes: Cast metal or[Sheet metal, fully adjustable.
4. Nonmetallic Floor Boxes: Non-adjustable, rectangular.
5. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb.
6. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
7. Small sheet metal pull and junction boxes.
8. Cast-metal access, pull, and junction boxes.
9. Box extensions.
10. Gangable boxes are allowed.
11. Hinged-Cover Enclosures: Metal or Nonmetallic.
12. Cabinets: Galvanized steel.

H. Handholes and Boxes for Exterior Underground Wiring: Polymer concrete with polymer-concrete, Fiberglass with polymer-concrete, Fiberglass with reinforced concrete, Fiberglass with cast-iron, Fiberglass with hot-dip galvanized-steel diamond-plate or Fiberglass with fiberglass frame and cover, prototype tested for compliance with SCTE 77.

1. Configuration: Open bottom.
2. Weatherproof cover.
3. Cover Legend: "ELECTRIC."

1.4 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: RMC or RNC, Type EPC-80-PVC.
2. Concealed, Aboveground: RMC.
3. Underground: RNC, Type EPC-40-PVC, Type EPC-80-PVC,.
4. Connection to Vibrating Equipment: LFMC.
5. Boxes and Enclosures, Aboveground: Type 3R.

B. Indoors:

1. Exposed, Not Subject to Physical Damage: EMT
2. Exposed, Not Subject to Severe Physical Damage: EMT.

3. Exposed and Subject to Severe Damage: RMC.
4. Concealed: EMT.
5. Connection to Vibrating Equipment: FMC, except LFMC in damp or wet locations.
6. Damp or Wet Locations: RMC.
7. Boxes and Enclosures: Type 1, except Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Threaded rigid steel conduit fittings.
2. PVC Externally Coated, Rigid Steel Conduits: Fittings listed for use with this type of conduit.
3. EMT: Setscrew or compression fittings.
4. Flexible Conduit: Fittings listed for use with flexible conduit.

1.5 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified."

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. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with NFPA 70.
2. N. J. Uniform Construction Code

3. NECA 1

1.7 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.
10. Or Approved Equal.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

E. EMT: ANSI C80.3.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Fittings for EMT: Insulated set screws ½" through 2"; compression type 2 ½" through 4"; pie cast fittings are not permitted.
2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.
13. Or Approved Equal.

B. RNC: NEMA TC 2, Type EPC-40-PVC unless otherwise indicated.

C. LFNC: UL 1660.

D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

E. Fittings for LFNC: UL 514B.

2.4 SURFACE RACEWAYS

A. Surface Nonmetallic Raceways: Two or three-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems Division.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.
d. Or Approved Equal.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
14. Or Approved Equal.

B. Galvanized Steel Outlet Boxes: Standard galvanized steel boxes and device covers by Appleton Electric Co., Beck Mfg./Picoma Industries, Cooper/Crouse-Hinds, Raco/Div. of Hubbell, or Steel City/T & B Corp or approved equal.

C. Galvanized Steel Junction and Pull Boxes: Code gage, galvanized steel screw cover boxes by Delta Metal Products Inc., Hoffman Enclosures Inc., Hubbell Wiegmann, Lee Products Co., or Rittal/Electromate or approved equal.

D. Threaded Type Boxes:
1. Outlet Boxes:
a. For Dry, Damp Locations: Zinc electroplate malleable iron or cast iron alloy boxes by Appleton Electric Co., Cooper/Crouse-Hinds Co., OZ/ Gedney Co., or Thomas & Betts Corp. with zinc electroplate steel covers to suit application or approved equal.

b. For Wet Locations: Malleable iron or cast iron alloy boxes with hot dipped galvanized or other specified corrosion resistant finish as produced by Cooper/Crouse-Hinds (hot dipped galvanized or Corro-free epoxy powder coat), OZ/Gedney Co. (hot dipped galvanized), or Thomas & Betts Corp. (hot dipped galvanized) with stainless steel cover screws, and malleable iron covers gasketed to suit application or approved equal.

2. Adfa. Junction and Pull Boxes:

a. For Dry, Damp Locations: Zinc electroplate cast iron boxes by Appleton Electric Co., Cooper/Crouse-Hinds, OZ/Gedney Co., or Thomas & Betts Corp. with zinc electroplate steel or cast iron cover or approved equal.

b. For Wet Locations: Cast iron boxes by Cooper/Crouse-Hinds' (hot dipped galvanized or Corro-free epoxy powder coat), OZ/Gedney Co. (hot dipped galvanized), or Thomas & Betts Corp. (hot dipped galvanized) with stainless steel cover screws and cast iron cover gasketed to suit application or approved equal.

3. Conduit Bodies, Threaded (Provided with a Volume Marking):

a. For Dry, Damp Location: Zinc electroplate malleable iron or cast iron alloy bodies with zinc electroplate steel covers; Appleton Electric Co.'s Unilets, Cooper/Crouse-Hinds' Condulets, OZ/Gedney Co.'s Conduit Bodies, or Thomas & Betts Corp.'s Conduit Bodies or approved equal.

b. For Wet Locations: Malleable iron or cast iron alloy bodies with hot dipped galvanized or other specified corrosion resistant finish; Cooper/Crouse-Hinds' Condulets (hot dipped galvanized or Corro-free epoxy power coat), OZ/Gedney Co.'s Conduit Bodies (hot dipped galvanized), or Thomas & Betts Corp.'s Conduit Bodies (hot dipped galvanized) with stainless steel cover screws and malleable iron covers gasketed to suit application or approved equal.

E. Specific Purpose Outlet Boxes: As fabricated by equipment manufacturers for mounting their equipment thereon.

F. Outlet Boxes and Related Products for Fire Rated Construction:

1. Parameters For Use of Listed Metallic Outlet or Switch Boxes: UL Electrical Construction Equipment Directory - Metallic Outlet Boxes (QCIT).
2. Wall Opening Protective Materials: As listed in UL Fire Resistance Directory - Wall Opening Protective Materials (CLIV), or UL Electrical Construction Equipment Directory - Wall Opening Protective Materials (QCSN).

F. Floor Power/Data Boxes (FB):

1. Three gang configuration, stamped steel floor box. Box shall be 3 by 4 by 11 inches nominal and have recessed power activations and data and audio/video compartments. Knockouts shall be available in ½", ¾", and 1 inch sizes.
2. Provide three gang polycarbonate concrete floor flange, color as selected by Architect.
3. Model Wiremold Evolution series or approved equal.

G. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

H. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

I. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

J. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.

K. Nonmetallic Floor Boxes: Nonadjustable, round.

L. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

M. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum or galvanized, cast iron with gasketed cover.

N. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.

O. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

1. Manholes for service conduits or duct banks shall be constructed and placed in accordance with the requirements of the affected utility company. All handholes for utility service shall comply with all requirements, including Manufacturer, of the affected utility company.

B. Description: Comply with SCTE 77.

1. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
2. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
3. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
4. Cover Legend: Molded lettering, as indicated for each service.
5. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Manufacturers:

a. AC Miller Concrete Products
b. Armorcast Products Company
c. Carson Industries LLC.
d. CDR Systems Corporation.
e. NewBasis.
f. Rotondo Precast.
g. Quazite.
h. Or Approved Equal.

D. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Manufacturers:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. Christy Concrete Products.
d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
e. Or Approved Equal.

E. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.

1. Manufacturers:

a. Carson Industries LLC.
b. Christy Concrete Products.
c. Nordic Fiberglass, Inc.
d. Or Approved Equal.

2.7 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.8 SLEEVE SEALS

A. Manufacturers:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.
5. Or Approved Equal.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.9 SUPPORTING DEVICES

A. Fasteners: Furnish all fasteners and hardware compatible with the materials and methods required for attachment of supporting devices.

1. Slotted Type Concrete Inserts: Galvanized pressed steel plate complying with ASTM A 283; box-type welded construction with slot designed to receive steel nut and with knockout cover, hot-dipped galvanized in compliance with ASTM A 123.
2. Masonry Anchorage Devices: Expansion shields complying with FS FF-S-325, as follows:
    a. Furnish lead expansion shields for machine screws and bolts 1/4 inch and smaller; head-out embedded nut type, single unit class, Group I, Type I, Class 1.
    b. Furnish lead expansion shields for machine screws and bolts larger than 1/4 inch in size; head-out embedded nut type, multiple unit class, Group I, Type 1, Class 2.
    c. Furnish bolt anchor expansion shields for lag bolts, zinc alloy, long-shield anchors class, Group II, Type 1, Class 1.
    d. Furnish bolt anchor expansion shields for bolts, closed-end bottom bearing class, Group II, Type 2, Class 1.

3. Toggle Bolts: Tumble-wing type, complying with FS FF-B-588C, Type, class and style as required.
4. Nuts, Bolts, Screws, Washers:
    a. General: Furnish zinc-coated fasteners, with galvanizing complying with ASTM A 153 for exterior use or where built into exterior walls. Furnish fasteners for the type, grade and class required for the particular installation.
    b. Standard Nuts and Bolts: Regular hexagon head type, complying with ASTM A 307, Grade A.
    c. Lag Bolts: Square head type, complying with FS FF-B-561C.
    d. Machine Screws: Cadmium plated steel, complying with FS FF-S-92.
    e. Wood Screws: Flat head carbon steel, complying with FS FF-S-111.
    f. Plain Washers: Round, general assembly grade carbon steel, complying with FS FF-W-92.
    g. Lock Washers: Helical spring type carbon steel, complying with FS FF-W-84.

B. "C" Beam Clamps:
1. For 1 inch Conduit Maximum: B-Line Systems Inc.'s BG-8-C2, BP-8-C1 Series, or Caddy Fastener Div./Erico Products Inc.'s BC-8P and BC-8PSM Series or approved equal.
2. For 3 inch Conduit Maximum: Appleton Electric Co.'s BH-500 Series beam clamp with H50WB Series hangers, Kindorf/T&B Corp.'s 500 Series beam clamp with 6HO-B Series hanger, or OZ/Gedney Co.'s IS-500 Series beam clamp with H-OWBS Series hanger or approved equal.
3. For 4 inch Conduit Maximum: Kindorf/T&B Corp.'s E-231 beam clamp and E-234 anchor clip and C-149 series lay-in hanger, or Unistrut Corp.'s P2676 beam clamp and P-1659A Series anchor clip with J1205 Series lay in hanger or approved equal.
4. For Threaded Rods (100 lbs. load max.): Caddy Fastener Div./Erico Products Inc.'s BC-4A or approved equal.
5. For Threaded Rods (200 lbs. load max.): Appleton Electric Co.'s BH-500 Series, Kindorf/T&B Corp.'s 500 Series, or OZ/Gedney Co.'s IS-500 Series or approved equal.
6. For Threaded Rods (300 lbs. load max.): Kindorf/T&B Corp.'s E-231 beam clamp and E-234 anchor clip, or Unistrut Corp.'s P2676 beam clamp and P-1659A Series anchor clip or approved equal.

C. Fastener Fittings for Wood and Existing Masonry: Kindorf/T&B Corp.'s E-243, E-244, E-245, E-170, or Versabar Corp.'s VX-4310, VX-2308, VX-4308, VX-4309 or approved equal.

D. Pipe Straps: Two hole steel conduit straps; Kindorf/T&B Corp.'s C-144 or C-280 Series or approved equal.

E. Pipe Clamps: One-hole malleable iron type clamps; Kindorf/T&B Corp.'s HS-400 Series, or OZ/Gedney Co.'s 14-50 Series or approved equal.

F. Channel Support System and Accessories: 12 gage galvanized steel channel and accessories; B-Line System Inc.'s B-22 (1-5/8 x 1-5/8 inches), B-12 (1-5/8 x 2-7/16 inches), B-11 (1-5/8 x 3-1/4 inches), Kindorf/T&B Corp.'s B-900 (1-1/2 x 1-1/2 inches), B-901 (1-1/2 x 1-7/8 inches), B-902 (1-1/2 x 3 inches), Unistrut Corp.'s, P-3000 (1-3/8 x 1-5/8 inches), P-5500 (1-5/8 x 2-7/16 inches), P-5500 (1-5/8 x 3-1/4 inches), or Versabar Corp.'s VA-1 (1-5/8 x 1-5/8 inches), VA-3 (1-5/8 x 2-1/2 inches) or approved equal.

G. Supporting Fasteners (Metal Stud Construction): Metal stud supports, clips and accessories as produced by Caddy/Erico Products Inc. or approved equal.

2.10 NAMEPLATES AND TAGS

A. General: Precision engraved letters and numbers with uniform margins, character size minimum 3/16 inch high.

1. Phenolic: Two color laminated engraver's stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).
2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.
3. Materials for Outdoor Applications: As recommended by nameplate manufacturer to suit environmental conditions.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit or IMC.
2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC or EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or 4.
5. Non-Metallic Conduit
   a. Schedule 40 – Where raceways are in slab in below grade levels, for raceway duct banks.
   b. Schedule 80 – For underground raceways outside of building which are not encased in concrete.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit or IMC. Includes raceways in the following locations:
3.
   a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   b. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit or IMC.
7. Corrosive areas: PVC coated RMC.
8. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
9. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway or EMT.

10. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway or EMT.
11. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel or nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed. Install a maximum of 150 feet between pull points, and reduce this by 25 feet for each 90 degree bend. Underground conduits for site lighting may be run a maximum of 200 feet between pole lights without an additional pull point. Underground service conduits shall meet the requirements of the utility company.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. Install exposed at surface cabinets and for motor and equipment connection in electrical and mechanical rooms. Surface mounted installations in occupied areas, where allowed on the drawings, shall be equipped with skirts to cover conduits above and below the panels or boxes. Provide one empty 3/4 inch raceway for each three spare unused poles or spaces of each flush-mounted panelboard. Terminate empty 3/4 inch conduit in junction box, which after completion, is accessible to facilitate future branch circuit extension.

H. Locate raceways so that strength of structural members is unaffected and they do not conflict with services of other trades. Install 1-inch or larger raceways in or through structural members (beams, slabs, etc.) only when and in manner accepted by Engineer. Draw up couplings and fittings full and tight. Protect exposed threads from corrosion by coating with red lead or zinc chromate after installation.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Securely tie embedded raceway in place prior to embedment.
3. Raceways installed below or in floor slabs must extend minimum of 6 inches above finished slab to first connector, unless otherwise noted.
4. Lay out work in advance to avoid excessive concentrations of raceway runs.
5. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
6. Change from RNC, Type EPC-40-PVC to rigid steel conduit, or IMC before rising above the floor.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

L. Tighten set screws of threadless fittings with appropriately sized screwdriver or nut driver as suits the screw design.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

N. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
4. All communications conduits and sleeves shall be terminated with non-metallic bushings.

O. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

P. Refer to Division 27 Section “COMMUNICATIONS AND DATA SYSTEMS RACEWAYS” for additional requirements.

Q. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

R. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures. For equipment subject to vibration, noise transmission, or movement; and for all motors use a maximum of 36 inches of flexible conduit. Use LFMC in damp or wet locations. Install separate ground conductor across or through all flexible connections. Comply with NFPA 70 if more restrictive.

S. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Install a second isolated ground conductor to receptacles or other devices requiring an isolated ground.

T. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces or from outside to inside above ground. Explosion proof type seals are not required for this application.
2. Where otherwise required by NFPA 70.

U. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
c. Conduits routed on rooftops within 6 inches of the roof surface shall be designed for an additional 30 degrees F temperature rise.
d. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
e. Attics: 135 deg F temperature change.

2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

V. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

3.3 BOXES

A. Recessed Boxes in Masonry Walls: Saw-cut opening for box in masonry block horizontally in center of cell and vertically with the top flush with the top of the block, and install box flush with surface of wall. Saw cuts shall not extend more than 1/8 inch beyond box dimensions. Repair any block surfaces to original condition if saw cuts exceed this dimension. Adjust mounting height of box as required to maintain all boxes in a single course to align with the same edge of the blocks. Electrical Contractor shall be responsible for ensuring all unacceptable block cuts are repaired.

B. Recessed boxes in drywall Walls: Outlet and device boxes shall be securely and rigidly attached or supported plumb, level, and true.

C. Outlet and device boxes shall be located so as to not be blocked by furniture, millwork other equipment, or otherwise rendered not accessible or functional. Contractor shall relocate any boxes not meeting these criteria at no cost to the project.

D. The boxes shall be located so that the cover or device plate will not span different types of building finishes either vertically or horizontally. Mounting heights shall be adjusted to prevent covering different finish materials, but shall remain within the parameters of the New Jersey Barrier Free Subcode.

E. Boxes for switches near doors shall be located on the side opposite the hinge and close to the door trim.

F. Covers for outlet boxes shall be of a type designed, intended and appropriate for the use and location, and have suitable corrosion protection. Device plates shall not be used as covers for exposed installations. Plates shall be installed plumb.

G. Back to back outlets are not allowed in any wall. Boxes located on opposite side of fire rated walls shall be separated horizontally by a minimum of two feet. Where this separation is not feasible or desirable, such as for switches at doorways, provide fire stop pads behind each box to maintain fire wall rating.

H. Set metal floor boxes level and flush with finished floor surface.

I. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

J. Junction and pull boxes shall be used where necessary to facilitate the pulling of wire or cable.

K. Consideration shall be given to the size and number of conductors, number of bends in the raceway, and the need for support of conductors in vertical raceways.

L. Junction and pull boxes shall be of a type intended or suitable for the use and location.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.7 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.8 OUTLET, JUNCTION AND PULLBOX INSTALLATION

A. Mounting Position of Wall Outlets For Wiring Devices: Unless otherwise indicated, install boxes so that the long axis of each wiring device will be vertical.

B. Height of Wall Outlets: Unless otherwise indicated, locate outlet boxes with their center lines at the following elevations above finished floor:

	MOUNTING HEIGHT
Lighting Fixtures	6'-0"
Exit Lights	8'-0" where ceiling height allows a minimum of 6 inch clearance between ceiling and top of exit light. Otherwise mount exit light so that it's top is 6 inches below finished ceiling. Adjust height and clearances as required to suit installation over doors.
Switches	4'-0"
Single & Duplex Receptacles	1'-6"*
Water Cooler Receptacles	2'-0"
IP Digital Clock Data Receptacles	7'-6"
Special Purpose Receptacles	4'-0"
Manual Fire Alarm Boxes	4'-0"
Audible Notification Appliances	8'-0" where ceiling height allows a minimum of 6 inch clearance between ceiling and top of appliance. Otherwise mount appliance so that it's top is 6 inches below finished ceiling.
Visible Notification Appliances	Install outlet so that the bottom of the visible lens will be 6'-8"AFF.
Combination Audible/Visible Notification Appliances	Install outlet so that the bottom of the visual lens will be 6'-8" AFF, and the audible section will be above the visible section.
Telecommunications	2'-0"
Data	1'-6"
Data Marked H.	Install outlet so that the highest operable part of the wall mounted telephone will not be more than 4'-0" AFF.

*In areas containing heating convectors, install outlets above convectors at height indicated on drawings.

C. Supplementary Junction and Pull Boxes: In addition to junction and pull boxes indicated on the drawings and required by NFPA 70, provide supplementary junction and pull boxes as follows:

1. When required to facilitate installation of wiring.
2. At every third 90 degree turn in conjunction with raceway sizes over 1 inch.
3. At intervals not exceeding 100 feet in conjunction with raceway sizes over 1 inch.

D. Box Schedule for Concealed Conduit System:

1. Non-Fire Rated Construction:
   a. Depth: To suit job conditions and comply with NFPA 70 Article 370.
   b. For Lighting Fixtures: Use galvanized steel outlet boxes designed for the purpose.
      1) For Fixtures Weighing 50 lbs. or Less: Box marked "FOR FIXTURE SUPPORT".

2) For Fixtures More Than 50 lbs: Box listed and marked with the weight of the fixture to be supported (or support fixture independent of the box).

c. For Ceiling Suspended Fans:

1) For Fans Weighing 35 lbs or Less: Marked “Acceptable for Fan Support.”

2) For Fans Weighing More Than 35 lbs, up to 70 lbs: Marked “Acceptable for Fan Support up to 70 lbs (or support fan independent of the box).”

d. For Junction and Pull Boxes: Use galvanized steel boxes with flush covers.

e. For Switches, Receptacles, Etc:

1) Plaster or Cast-In-Place Concrete Walls: Use 4 inch or 4-11/16 inch galvanized steel boxes with device covers.

2) Walls Other Than Plaster or Cast-In-Place Concrete: Use type of galvanized steel box which will allow wall plate to cover the opening made for the installation of the box.

2. Recessed Boxes in Fire Rated (2 hour maximum) Bearing and Nonbearing Wood or Steel Stud Walls (Gypsum Wallboard Facings):

a. Use listed single and double gang metallic outlet and switch boxes. The surface area of individual outlet or switch boxes shall not exceed 16 square inches.

b. The aggregate surface area of the boxes shall not exceed 100 square inches per 100 square feet of wall surface.

c. Securely fasten boxes to the studs. Verify that the opening in the wallboard facing is cut so that the clearance between the box and the wallboard does not exceed 1/8 inch.

d. Separate boxes located on opposite sides of walls or partitions by a minimum horizontal distance of 24 inches. This minimum separation distance may be reduced when wall opening protective materials are installed according to the requirements of their classification.

e. Use wall opening protective material in conjunction with boxes installed on opposite sides of walls or partitions of staggered stud construction in accordance with the classification requirements for the protective material.

3. Other Fire Rated Construction: Use materials and methods to comply with the listing requirements for the classified construction.

E. Box Schedule for Exposed Conduit System:

1. Dry and Damp Locations: Use zinc electroplate or hot dipped galvanized threaded type malleable iron or cast iron alloy outlet, junction, and pullboxes or conduit bodies provided with a volume marking in conjunction with ferrous raceways unless otherwise specified or indicated on the drawings.

a. Galvanized steel boxes may be used in conjunction with conduit sizes over 1 inch in non-hazardous dry and damp locations.

b. Galvanized steel boxes may be used in conjunction with electrical metallic tubing where it is allowed (specified) to be installed exposed as branch circuit conduits at elevations over 10’-0” above finished floor.

2. Wet Locations: Use threaded type malleable iron or cast iron alloy outlet junction, and pullboxes or conduit bodies (provided with a volume marking) with hot dipped galvanized or other specified corrosion resistant coating in conjunction with ferrous raceways unless otherwise specified or indicated on the drawings.

a. Use corrosion resistant boxes in conjunction with plastic coated rigid ferrous metal conduit.

3. Finishing Collar or Combination Finishing Collar/Outlet Box (Surface Mounted Equipment Used With Exposed Raceway):

   a. Use finishing collar where surface mounted equipment is installed on an exposed raceway outlet box and the equipment base is larger than the outlet box.

   b. Use combination finishing collar/outlet box where surface mounted equipment is not indicated to be installed on an exposed raceway outlet box, but raceway cannot be run directly into equipment body due to equipment design.

F. Specific Purpose Outlet Boxes: Use to mount equipment when available and suitable for job conditions. Unless otherwise specified, use threaded type boxes with finish as specified for exposed conduit system, steel (painted) for surface metal raceway system and galvanized steel for recessed installations.

3.9 SUPPORTING DEVICE INSTALLATION

A. Attachment of Conduit System:

1. Wood Construction: Attach conduit to wood construction by means of pipe straps with wood screws or lag bolts.

2. Masonry Construction: Attach conduit to masonry construction by means of pipe straps and masonry anchorage devices.

3. Steel Beams: Attach conduit to steel beams by means of “C” beam clamps and hangers.

4. Multiple Parallel Conduit Runs: Use channel support system.

5. Conduit Above Suspended Ceiling: Do not rest conduit directly on runner bars, T-bars, etc. Support conduit from ceiling supports or from construction above suspended ceiling.

B. Metal Stud Construction: Attach raceways and boxes to metal studs by means of supporting fasteners manufactured specifically for the purpose.

1. Support and attach outlet boxes so that they cannot torque/twist. Either:

   a. Use bar hanger assembly, or;

   b. In addition to attachment to the stud, also provide far side box support.

C. Support of Lighting Fixtures:

1. General: Support fixtures with suitable accessories.

2. Number of Supports (LED Fixtures):

   a. Support individual LED fixtures less than 2 feet wide at 2 points. Support continuous row fluorescent fixtures less than 2 feet wide at points equal to the number of fixtures plus one. Uniformly distribute the points of suspension over the row of fixtures.

   b. Support individual LED fixtures 2 feet or wider at 4 corners. Support continuous row fluorescent fixtures 2 feet or wider at points equal to twice the number of fixtures plus 2. Uniformly distribute the points of suspension over the row of fixtures.

END OF SECTION 260533

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Wall-box motion sensors.
3. Snap switches and wall-box dimmers.
4. Wall-switch and exterior occupancy sensors.
5. Cord and plug sets.
6. Multioutlet assemblies.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
5. Or Approved Equal.

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

e. Or Approved Equal.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Cooper; XGF20.
b. Hubbell; GF5352.
c. Leviton; 6898.
d. Pass & Seymour; 2084.
e. Bryant
f. Or Approved Equal.

2.4 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Furnished on equipment provided by owner.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Cooper; 2221PL for 120 V and 277 V.

b. Hubbell; HPL1221PL for 120 V and 277 V.
c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Cooper; 2221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.6 RECEPTACLES

A. Specification Grade Receptacles:

1. Single receptacle, NEMA 5-15R (15A, 125 V, 2P, 3W); Bryant's 5251, Crouse-Hinds/AH's 5251, Hubbell's 5251, Leviton's 5251, Pass & Seymour's 5251, or approved equal.
2. Duplex receptacle, NEMA 5-15R (15A, 125 V, 2P, 3W); Bryant's 5252/5242, Crouse-Hinds/AH's 5252/5242, Hubbell's 5252/5242, Leviton's 5252/5242, Pass & Seymour's 5252/5242, or approved equal.
3. Single receptacle, NEMA 5-20R (20A, 125 V, 2P, 3W); Bryant's 5361/5351, Crouse-Hinds/AH's 5361/5351, Hubbell's 5361/5351, Leviton's 5361/5351, Pass & Seymour's 5351, or approved equal.
4. Duplex receptacle, NEMA 5-20R (20A, 125 V, 2P, 3W); Bryant's 5362, Crouse-Hinds/AH's 5352/5342, Hubbell's 5352, Leviton's 5352, Pass & Seymour's 5352, or approved equal.

B. Electric Clock Receptacles:

1. Single receptacle, NEMA 5-15R (15A, 125 V, 2P, 3W), brass or stainless steel face plate to match hardware; Bryant's 2828-G, 2828-GS, Crouse-Hinds/AH's 5708, Hubbell's 5233, 5235, Leviton's 5261-CH, Pass & Seymour's S3733, S3733-SS, or approved equal.

C. Ground Fault Interrupter Receptacles:

1. Duplex receptacle rated 15A (NEMA 5-15R), circuit-ampacity 20A; Bryant's GFR52FT, Crouse-Hinds/AH's GF5242, Hubbell's GF5252, Leviton's 6599, Pass & Seymour's 1591S, Daniel Woodheads 5252GF, or approved equal.
2. Duplex receptacle rated 20A (NEMA 5-20R), circuit ampacity 20A; Bryant's GFR53FT, Crouse-Hind/AH's GF5342, Hubbell's GF 5352, Leviton's 6899, Pass & Seymour's 2091S, Daniel Woodheads 5352GF, or approved equal.

D. Weather Resistant Ground Fault Interrupter Receptacles:

1. Duplex receptacle rated 15A (NEMA 5-15R), circuit-ampacity 20A; Cooper's WRVGF15W, Leviton's 002-W7599-00W, or approved equal.
2. Duplex receptacle rated 20A (NEMA 5-20R), circuit ampacity 20A; Cooper's WRVGF20W, Leviton's 002-W7899-00W, or approved equal.

E. Special Purpose Receptacles: Furnish matching nylon, polycarbonate or armored plug with each receptacle. Furnish matching wall plate with each receptacle (.040" brass, Type 302 stainless steel, weatherproof, threaded box type, as required):

1. Type A: NEMA 14-20R (3P, 4W, 20A, 125/250 V, W/G); Crouse-Hinds/AH's 5759, General Electric's 1420, Hubbell's 8410, or approved equal
2. Type B: NEMA 14-30R (3P, 4W, 30A, 125/250 V, W/G); Bryant's 9430FR, Crouse-Hinds/AH's 5744N, Hubbell's 9430A, Leviton's 278, Pass & Seymour's 3864, or approved equal.
3. Type C: NEMA 14-50R (3P, 4W, 50A, 125/250 V, W/G); Bryant's 9450FR, Crouse-Hinds/AH's 5754N, Hubbell's 9450A, Leviton's 279, Pass & Seymour's 3894, or approved equal.
4. Type D: NEMA 14-60R (3P, 4W, 60A 125/250 V, W/G); Bryant's 9460FR, Crouse-Hinds/AH's 9460N, Hubbell's 9460A, Pass & Seymour's 3871, or approved equal.
5. Type E: NEMA 10-20R (3P, 3W, 20A, 125/250 V); Bryant's 9326, Crouse-Hinds/AH's 9140, Hubbell's 6810, Pass & Seymour's 6810, or approved equal.
6. Type F: NEMA 10-30R (3P, 3W, 30A, 125/250 V); Bryant's 9303, Crouse-Hinds/AH's 9344N, Hubbell's 9350, Leviton's 5207, Pass & Seymour's 3860, or approved equal.
7. Type G: NEMA 10-50R (3P, 3W, 50A, 125/250 V); Bryant's 9306, Crouse-Hinds/AH's 7985N, Hubbell's 7962, Leviton's 5206GR, Pass & Seymour's 3890, or approved equal.
8. Type H: NEMA L5-15R (2P, 3W, 15A, 125 V, W/G); Bryant's 4710, Crouse-Hinds/AH's 4710, Hubbell's 4710, Pass & Seymour's 4710, or approved equal.
9. Type I: NEMA L5-20R (2P, 3W, 20A 125 V, W/G); Bryant's 70520FR, Crouse-Hinds/AH's 6200, Hubbell's 2310A, Pass & Seymour's L520-R, or approved equal.
10. Type J: NEMA L5-30R (2P, 3W, 30A, 125 V, W/G); Bryant's 70530FR, Crouse-Hinds/AH's 6330, Hubbell's 2610A, Leviton's 70530-FR, Pass & Seymour's L530-R, or approved equal.
11. Type K: NEMA L6-15R (2P, 3W, 15A, 250 V, W/G); Bryant's 70615FR, Crouse-Hinds/AH's 6560, Hubbell's 4560, Leviton's 70615FR, Pass & Seymour's 4560, or approved equal.
12. Type L: NEMA L6-20R (2P, 3W, 20A, 250 V, W/G); Bryant's 70620FR, Crouse-Hinds/AH's 6210, Hubbell's 2320A, Leviton's 70620-FR, Pass & Seymour's L620-R, Slater's L620R, or approved equal.
13. Type M: NEMA L6-30R (2P, 3W, 30A, 250 V, W/G); Bryant's 70630FR, Crouse-Hinds/AH's 6340, Hubbell's 2620, Pass & Seymour's L630-R, or approved equal.

2.6 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting .
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with lift cover, and listed and labeled for use in "wet locations while in use."

Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant while in use, die-cast aluminum with lockable cover.

B. Brass Wall Plates: .040 inch thick brass with brush brass finish; Bryant's 518 Series, Hubbell's B Series or 94 Series, Leviton's 81 Series, Pass & Seymour's B Series, or approved equal.

C. Stainless Steel Wall Plates: Type 302 stainless steel with satin finish; Bryant's 93 Series, Crouse-Hinds/AH's 93 Series, Hubbell's 93 Series, Leviton's 910 -40 Series, Pass & Seymour's 93 Series, or approved equal.

D. Weatherproof Covers: Crouse-Hinds WLRS, WLRD, Hubbell's 52, 74 Series, Pass & Seymour's 45 Series, or approved equal.

E. Weatherproof While In Use Covers:

1. Polycarbonate: Cooper Crouse-Hinds TP7488W, Pass & Seymour's (Legrand) WIUC10C, or approved equal.
2. Metallic: Hubbell's WP826 or WP826H, Thomas and Betts' (Red Dot) CKMUV or CKMU, Leviton's M5979-0GY or M5999-0GY, or approved equal

F. Covers for Threaded Type Boxes: Stamped sheet steel, gasketed device covers as produced by Crouse-Hinds Co., OZ/Gedney Co., or approved equal.

2.7 EMERGENCY SHUTDOWN SWITCHES

A. Emergency Shutdown Pushbutton Switch: Square D. Co.'s Class 9001 or approved equal, Type K, pushbutton operator with the following:

1. Red mushroom button.
2. Transformer type red pilot light.
3. Legend red plate with words "Emerg. Stop".
4. NEMA 13 oil tight enclosure with cover riveted to boy.

B. Emergency Shutdown Key Operated Switch: Square D. Co.'s Class 9001 or approved equal, Type K, key operated selector switch with the following:

1. Key removable in both "ON" and "OFF" position.
2. NEMA 13 oil tight enclosure with cover riveted to box.

2.8 NAMEPLATES

A. Phenolic Type: Standard phenolic nameplates with 3/16 inch minimum size lettering engraved thereon.

B. Embossed Aluminum: Standard stamped or embossed aluminum tags, 3/16 inch minimum size lettering, as produced by Seton Name Plate Corp. or Tech Products Inc.

2.9 FLOOR SERVICE FITTINGS

A. Service fittings in first paragraph below are available for voice and data communication cabling as well as for power. Edit to suit Project.

B. Type: Modular, flush-type , dual-service units suitable for wiring method used.

C. Compartments: Barrier separates power from voice and data communication cabling.

D. Service Plate: Round, solid brass with satin finish.

E. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish for general receptacles; white for computer receptacles, unless otherwise indicated.

F. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 6 jacks for UTP cable.

2.10 MULTIOUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold Company (The).
3. Or Approved Equal.

B. If not indicated on Drawings, add mounting heights, raceway sizes, and types and spacing of receptacle devices to paragraph below. Add descriptions of special features in assemblies such as fused receptacles, special-purpose switches, and channels for communication wiring.

C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: As shown on plans.

E. Wire: No. 12 AWG.

2.7 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices connected for general duty shall be grey; connected for computers shall be white, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Install wiring devices in outlet boxes.

B. Local Switches:

1. Install local switches rated 15A, 120/277 V ac for switches unless otherwise shown on the drawings or specified.
2. Install switches indicated Sa, Sb, Sc, etc, for control of outlets, with corresponding letters on the same circuit.

3. Where more than one switch occurs at same location in a 120 volt system, arrange switches in gangs and cover with one face plate.
4. Install switches in a 277 volt system in separate single boxes if voltage between exposed live metal parts of adjacent switches exceeds 300 volts.
5. Install single and double pole switches so that switch handle is up when switch is in the “On” position.
6. Install key operated switches where shown on the drawings.

C. Receptacles:

1. Install Specification Grade receptacles, NEMA 5-15R, 15A, 125 V, 2P, 3W, for duplex receptacles and single receptacles unless otherwise shown on the drawings or specified.
2. Install receptacles with ground pole in the down position.
3. Install Weather Resistant Ground Fault Interrupter Receptacles in wet and damp locations.

D. Wall Plates:

1. Install wall plates on all wiring devices in dry locations, with finish to match hardware in each area.
2. Install hospital wall plates on Type HG receptacles.
3. Install blank wall plates on outlet boxes which are for future equipment except telephone outlets.
4. Install 5/8 inch bushed wall plates on telephone outlets.
5. Fasten wall plates with vandal resistant screws in patients’ area. Deliver 10 screw keys to the facility.

E. Weatherproof Covers: Install weatherproof covers on wiring devices in damp locations.

F. Weatherproof While In Use Covers: Install weatherproof while in use covers on wiring devices in wet locations.

G. Nameplates: Provide phenolic or embossed aluminum nameplate for each special purpose receptacle indicating phase, ampere and voltage rating of the circuit. Attach nameplate with rivets or tamperproof fasteners to wall plate or to wall above receptacle. Wall plates may be engraved with required data in lieu of separate nameplates.

H. Mats: Where flush plates are required over outlet boxes that cannot be set deep enough for the plates to fit closely over the finished wall surfaces, provide oak mats to fill the space between the finished wall surface and the plate.

I. Receptacles On Emergency Circuits: Install red colored receptacles. Engrave faceplates “EMERGENCY” in 3/16 inch high lettering and fill engraving with contrasting color filler material.

A. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.
5. Alternatively, if installed before wall repair or painting; provide protective covers for the devices. Replace any devices that have mortar, wallboard compound or are painted on visible or operative surfaces.
6. Openings or cuts around boxes, in wallboard or block walls, shall not exceed 1/8 inch. Coordinate repair of wall surface to match surrounding to comply with this requirement.

B. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

C. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

D. Receptacle Orientation:

1. Install ground pin GFCI receptacles so that wording is oriented for normal reading. Install ground pin of vertically mounted standard receptacles to match the orientation of GFCI receptacles.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening. No opening in the wall shall be visible around the plate.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Write on inside of device plate with indelible marker and use durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

END OF SECTION 262726

SECTION 283500 – HAZARDOUS MATERIAL GAS DETECTION AND ALARM

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 hazardous material monitors and notification appliances.

1.3 SYSTEM DESCRIPTION

A. Provide a complete design and installation of hazardous material gas detection and alarm systems where indicated or shown on drawings. System shall include, but not be limited to, building areas as indicated herein and on plans, and as required by code. Applicable system types to be applied are as follows:

1. Hazardous Material Emergency Alarm System

B. Drawings indicate material and equipment locations, and general design of gas detection systems.

C. Provide all system control components required for gas detection, alarms, alarm annunciation, emergency shutdown, area exhaust continuous airflow monitoring, manual alarm notification, ventilation direct interlocks, and security panel interface as required per Code and the specifications. Gas detection system shall monitor areas where hazardous vapors from a leak are likely to concentrate or leak. Alarms and equipment interlocks shall be actuated at building code specified percent lower explosion limit values and TLV/PEL ppm levels. System shall be capable of indicating, alarming, emergency shutdown of equipment, ventilation control and interfacing to the new Honeywell BMS system as indicated on drawings, and in governing Building Code regulations.

D. System design and content shall meet or exceed current state and federal codes and standards; including but not limited to International Mechanical Code, International Fire Code, National Electrical Code 70, Life Safety Code 101, and as applicable: NFPA 45, NFPA 55, OSHA CFR 29 Part 1910. System intrinsic safety design shall conform to CSA C22.2, No. 157, NEC / ISA, ANSI/ISA-RP 12.6, and NFPA-70 Article 504 requirements where required.

E. All devices shall be UL listed.

1.4 SUBMITTALS

A. Product Data: Manufacturer’s product technical data information for all system components.

B. Shop Drawings:

1. General system layout including all devices locations, device identification numbers along with sequence of operation, system interlock details for interface to building exhaust and ventilation system, building automation system, security system, etc.

2. Wiring Diagrams:

a. Include diagrams for equipment and for system with all terminals and interconnections identified.

b. Include all interconnections between components, control panels, and other system interfaces and devices. Include control panel wiring details.

3. Piping Diagrams: Include diagrams for equipment and for system with all interconnections identified.

C. Construction Documents: Include information specified in accordance with applicable codes and standards.

D. Code Compliance Documentation: Include code references and code trail, and hazard evaluation for each zone or area.

E. Product Certificates: UL listed.

F. Operation and Maintenance Data:

1. System operation description covering this specific Project.

2. Operating instructions for mounting at each control panel.

3. Operation and maintenance data for inclusion in Operating and Maintenance Manual.

1.5 WARRANTY

A. Hazardous Material Gas Detection and Alarm System shall be provided with a two (2) year warranty and all applicable recommended spare and consumable parts for two years of operation.

PART 2 - PRODUCTS

2.1 SAFETY SYSTEM SUPPLIER

A. Subject to compliance with requirements, provide turnkey hazardous material gas detection and alarm system including design responsibility, fabrication and installation.

B. Supplier shall be factory trained and authorized service center for gas detection products specified and factory authorized to provide code compliant turnkey system design, fabrication, installation, service and training of specified products.

2.2 MAIN CONTROL PANEL

A. Main control panel shall be wall mounted or free standing at location shown on plans, NEMA 12 enclosure painted safety blue, sized as required. Panel shall include gas system controller configured as required and interfaced to make a complete operating system. System controller shall have the ability to provide TCP/IP communication to transmit data to Remote Controllers and also the ability to communicate with a future computer system.

1. Provide HMI touch screen (see screen details below) with capability to display pertinent system information through (8) line digital display capable of full description for each input/output/alarm, emergency power terminal connections, shut down logic, alarm indication, emergency stop pushbutton, horn, beacons, contacts for retransmission of alarms to remote equipment and systems, circuit breakers, fuse protection, surge protection, all logic and interface relays, timers, power supply, terminal strips, wire ways, malfunction indication, power on indication, etc. as necessary to make complete operating system. Provide push button silence switch on front of control panel to acknowledge and silence or reset self-latching alarm circuit. Alarms shall stay latched to prevent them from automatically resetting when alarm condition goes away. Controller shall provide display of all channels, contacts necessary to provide code required interlocks and fault indication. Minimum viewing screen size 6”.

2. The HMI interface shall include the following screens:
   a. System Overview
   b. Zone Alarm
   c. History Trending
   d. System Status / Alarm History
   e. Sensor Status and Readings
   f. Connectivity
   g. Malfunction Alarm
   h. Calibration Mode

3. Gas Detection Controller: Provide controller with ability to provide a 15-minute TLV-TWA average value for refrigerant gas sensor. System shall be capable of storing no less than one-week sensor readings. During calibration, controller shall detect calibration signal at sensor and inhibit all alarms and denote sensor is in calibration. Provide "one-man" non-intrusive calibration. Size controller for minimum 20% spare capacity for future use.

4. Controller shall be one of the following as long as it complies with specification requirements: Drager Regard, SafeAir SafeGARD, MSA Suprema with accessory components as required to provide system operational logic.

5. Provide battery backup as specified.

6. Provide communication to site security system as noted in this document.

7. System shall be standalone and not dependent upon the proper operation of other systems.

B. Upon system reset, the alarm beacons shall be deactivated only if area monitored has returned to a safe condition. Purge ventilation systems shall remain activated for 30 minutes after alarm condition has cleared. A panel-mounted indicator shall denote that purge ventilation system is still activated and air flow proving device is sensing air flow. Provide a manual switch capability for "Auto - Manual On” purge fan control at the MCP and each remote panel where required.

C. Alarm Test. Provide capability inside each local panel to test alarm circuitry and panel indicators. During test function, interlock signals to FACP and other notification systems shall be disabled. Switch shall automatically reset.

2.3 EMERGENCY ALARM SYSTEM REMOTE I/O DISPLAY PANEL

A. Remote I/O Panel: Locate remote I/O panels as required to handle field mounted sensors and devices. Panel shall communicate to main system control panel and provide readout display of all system alarms. Panel shall serve as remote I/O for area gas detection sensors, emergency alarm annunciation devices, emergency alarm notification devices, safety shutoff valves, airflow input devices, etc. Panel shall be wall mount or freestanding, NEMA 12 enclosure painted safety blue, sized as required. Panel shall include gas detection system controller configured as required and interfaced to system network. System controller shall have the ability to provide TCP/IP communication to transmit data to Remote Controllers and also the ability to communicate with a future computer system.

B. Provide local HMI touch screen with full capability of main panel controller noted above in locations where remote display is specified.

C. Remote I/O panel shall be able to provide standalone operation in the event of a power failure or main system controller malfunction. Provide battery backup as specified.

2.4 INTERFACE TO OTHER SYSTEMS

A. The emergency alarm system shall provide the central interface to other facility systems as noted in the Emergency Shutdown Interlocks Matrix. These systems include but are not limited to the following:

1. Security System
2. Facility Monitoring System
3. Building Sprinkler System

2.5 REFRIGERANT GAS MONITORING SYSTEM

A. Gas monitoring system design and provision related to generation, production, storage, use, dispensing, mixing and handling of refrigerant / materials shall be in accordance with applicable code sections referring to emergency and standby power systems, emergency alarm systems, research and development areas, hazardous materials – general provisions, compressed gases. System shall also incorporate related system design criteria established by DOL 29 CFR.

1. System design specifics and sequence of operation shall address areas exceeding the maximum allowable quantity per control area and areas with quantities not exceeding the maximum allowable quantity per control area as directed by code.

2. Identify and submit, as required by code, applicable code references for each gas monitoring system designed component, alarm and control function per zone.

3. A gas detection system shall be provided to detect the presence of gas at or below the permissible exposure limit (PEL) or ceiling limit of the gas for which detection is provided. If a treatment system is required; the system shall be capable of monitoring the discharge from the treatment system at or below one-half the IDLH limit. Exception: A gas detection system is not required for toxic gases when the

physiological warning properties for the gas are at a level below the accepted PEL for the gas and the gas has a health hazard rating of 1 or 2 in accordance with NFPA 704.

4. Emergency shutdown interlocks, monitoring system interlocks and control interlocks shall be provided as defined in code. Additionally logic shall be as follows where applicable:
   a. Warning level alarm
      1) Amber beacon and horn at main panel, I/O panel and in zone.
      2) Control ventilation per code requirements.
      3) Zone Dry contact for Security System Input for each specific gas type.
      4) Panel indication for device in alarm.
   b. Danger level alarm
      1) Red beacon and horn at main panel, I/O panel and in zone.
      2) Control ventilation per code requirements.
      3) Zone Dry contact for Security System Input for each specific gas type.
      4) Panel indication for device in alarm.
   c. Malfunction Alarm
      1) Blue beacon and horn at panel.
      2) Common Dry contact for Security System Input.
      3) Panel indication for specific unit in fault.
   5. Equipment, machinery and required detection and alarm systems associated with the use, storage or handling of hazardous materials shall be listed or approved.

6. Ventilation systems for hazardous areas shall be designed to operate continuously at negative pressure in relation to surrounding area. Provide continuous airflow monitoring alarm for each applicable control area. Alarm initiating device to be rated general purpose per each applicable highly toxic and toxic gas; unless target gas is also flammable and concentration exceeds LEL, then alarm initiating device shall be explosion proof or intrinsically safe. Device input shall alarm as specific trouble to remote supervisory station, or other as defined per code. Applicable codes shall apply.

7. Where manual alarm and detection systems are required, such systems shall be connected to an emergency electrical system or a standby power system in accordance with code.

8. Manual alarms and detection systems required shall be supervised by an approved central, proprietary or remote station service or shall initiate an audible and visual signal at a constantly attended on-site location as defined by the AHJ.

9. Training shall be provided for persons responsible for operation of areas in which hazardous materials are stored, dispensed, handled or used. Responsible person shall be trained specifically to relate pertinent data from system, as liaison to fire department. Training shall include site system specific written emergency response procedures.

2.6 OTHER HARZARDOUS AREA EMERGENCY ALARM SYSTEM

A. Perform a risk-analysis for areas with a potential to create IDLH conditions for gases or cryogens that are not toxic or flammable. If required, design a gas monitoring system to warn occupants of IDLH conditions.

1. System design specifics and sequence of operation shall be approved by AHJ.

2. Identify and submit, as required by code, applicable code references for each gas monitoring system designed component, alarm and control function.

3. Combine gas monitoring with hazardous area emergency alarm system.

4. If required, a gas detection system shall be provided to detect the presence of gas at or below the permissible exposure limit (PEL) or ceiling limit of the gas for which detection is provided. Exception: A gas detection system is not required for toxic gases when the physiological warning properties for the gas are at a level below the accepted PEL for the gas and the gas has a health hazard rating of 1 or 2 in accordance with NFPA 704.

5. Gas detection system shall initiate a local alarm and transmit a signal to a constantly attended control station when a short-term hazard condition is detected. The alarm shall be visual and audible and shall provide warning both inside the control area and outside each entrance to the control area where gas is detected. The audible alarm shall be distinct from all other alarms.

6. Automatic closure of shutoff valves shall be in accordance with the building code. Provide oxygen cleaned where required.

7. Emergency shutdown interlocks, monitoring system interlocks and control interlocks shall be provided as defined in other similar portions of the specification.

8. Equipment, machinery and required detection and alarm systems associated with the use, storage or handling of hazardous materials shall be listed or approved.

9. If determine necessary, provide continuous airflow monitoring alarm for each applicable zone. Alarm initiating device to be rated general, explosion proof or intrinsically safe. Device input shall alarm as specific trouble to remote supervisory station.

10. Where manual alarm and detection systems are required, such systems shall be connected to an emergency electrical system or a standby power system.

11. Manual alarms and detection systems required shall be supervised by an approved central, proprietary or remote station service or shall initiate an audible and visual signal at a constantly attended on-site location as defined by the AHJ.

12. Training shall be provided for persons responsible for the operation of areas in which hazardous materials are stored, dispensed, handled or used. Responsible person shall be trained specifically to relate pertinent data from system, as liaison to the fire department. Training shall include site system specific written emergency response procedures.

2.7 FIELD DEVICES

A. Airflow Profile Test / Gas Detection Sensor Quantity and Location. Final design to be supported with Airflow Profile Test Report. Provide quantity and location of sensors based on bid documents. It is this system supplier’s responsibility after this system has been started up to provide accurate airflow profile testing and report with ventilation system operating under normal and operating under alarm conditions. Contactor shall document

recommended locations and quantities of sensors for code inspector approval (see installation, testing and acceptance procedures below). Sensor locations and quantities indicated herein are for reference purposes only and represent at best a minimum quantity of sensors required for this project. After approved review of simulated airflow test by AHJ, Fire Marshal and project engineer, supplier shall provide quantity of sensors deemed necessary by governing code official. Sensors required above the minimum quantity indicated within the contract documents shall be supplied as an extra to the project. Include an itemized price in your proposal to add each type sensor/transmitter assembly including related panel and field equipment, and installation cost per foot of electrical conduit.

B. Emergency Alarm Pushbutton / Pullstation (EAPB or ESP). Provide color coded, mushroom style, Emergency Pushbuttons / Pull Stations with Push – Pull action, SPDT switch rated per area requirements. Emergency pushbuttons shall be located at each point of use for refrigerant gas, within the path of egress from each control area and outside each control area, as required by code and at the control panel.

C. Alarm Horns and Beacons. Provide alarm horns and beacons equal to Edwards 102 Series Triliptical stackable flashing LED and steady on with optional tone module inside and outside of each control area / zone and at each entrance into a control area / zone as applicable. Beacons and horns shall be general purpose, NEMA 4x for outdoors, Class 1, Div. 1 or Div. II rated explosion proof as required; red, amber, and blue. In general, Red shall be high level % LEL alarm or high level toxic alarm, Amber shall be warning level for all, and Blue shall be system Malfunction/Trouble. For oxygen deficiency red alarm set point is less than 19.5% oxygen. For toxics, use three color stack amber, red and blue. For toxics, amber alarm at 50% of the PEL and red alarm at the PEL. Outdoor strobes shall be designed for visibility in daylight conditions. All remote visual and audible devices shall be 120 vac and powered from main control panel and emergency power source. Horns in high noise areas shall be rated for the db levels present as required by NFPA and shall be adjustable.

D. Tagging / Warning Signs / Area Maps. Signs to be pre-approved prior to installation.

1. Hazardous Area Entrance / Exit Signs at Annunciation Devices

a. Multi-Color Warning Signs. Provide multi-color lexan screen sign with black lettering at each remote visual and audible alarm warning device and where directed by plans and specifications. Sign size shall be minimum 8” wide and sized to match the height of the visual annunciation device and shall be horizontally aligned so that sign description is adjacent the appropriate beacon color. Tag background colors to match beacon color with black letter description internal to the background color. Tag lettering shall be aesthetically aligned and positioned next to each color alarm beacon so as to clearly identify the beacon function at a glance. Detailed gas type lettering contained within each section of the tag shall be no less than ½”; but 1” where capable.

b. A separate tag sized 3.5” x 8” shall denote Zone # and Area in Alarm.

2. Area Map. Provide color map, approximately 11”x 17” behind lexan protective frame at each control panel. Map to denote Zone I.D. / Areas being monitored. Include location and identification of input field devices; including but not limited to airflow switches, pushbuttons, sensors, etc. Color code each zone.

3. All warning signs must be approved by Owner Safety Department.

4. Emergency Pushbutton shall denote shutdown or interlock information.

5. Field Devices: Tag all field devices. Anchor tag to wall adjacent to wall mounted devices, suspend with brass security chain adjacent to ceiling mounted devices.

6. Signs shall comply with building code standards.

2.8 CALIBRATION GAS AND HARDWARE

A. Provide all necessary calibration gas and hardware for system start up, Fire Marshal acceptance testing and owner training.

B. After system start up and acceptance testing provide two (2) years of calibration complete with calibration gas and hardware kit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. System supplier shall have turnkey responsibility to provide mechanical and electrical installation, provide on-site installation supervision, and properly locate sampling points after review of room air flow and ventilation patterns.

B. Install control panels and electrical field devices in accordance with applicable codes and manufacturer's printed instructions. Install conduit and wire for all interlocks to each remote system. Make final electrical terminations. Installation personnel shall be trained in the proper installation and application of Gas Detection / Emergency Alarm Systems. Installer must be familiar with division 16 installation practices.

C. Install all wire, conduit and mounting hardware for interface to other building systems. Final termination into other system shall be by that other system contractor. For example: Security System contractor shall provide all necessary security system hardware, programming of his equipment, final termination, interface drawings, commissioning assistance as required to make a complete operating system. This also applies to Building Automation System Contractor, Fire Suppression, Test Cell Controls, Facility Monitor System, etc. Interlocks to other systems shall be direct connection and not through other systems.

D. Install all associated piping and tubing for airflow switches, dual condulet assembly calibration adaptor, emergency shutoff valves, etc. as required making a complete and operating approvable system.

3.2 FIELD QUALITY CONTROL

A. General:

1. Prior to project completion and when directed by Owner's Representative, thoroughly test and calibrate each field device and gas detection system for proper operation. Should corrections be required to any system, and after corrections have been completed, system shall be re-tested.

2. Assist MSU EHS and Physical Plant Maintenance Department in development of emergency procedures.

3. Tests shall be witnessed by Owner or his designated representative and a letter shall be submitted certifying system performance.

B. Safety Certification:

1. Furnish Owner with written report certifying that work has been accomplished with results. Provide Safety Certification documentation to the owner including the following: Air Flow Profile Report for each sample point location, Calibration Report with before and after results of each analyzer, Alarm / Interface Report stating all threshold levels, alarm and interface action at each level of alarm with field verification report, Safety Training Checklist, and List of all owner attendees.

2. Near end of warranty period of operation, provide similar service as described above complete with written report. Should a control or device be suspect in its operation or function, this deficiency shall be reported to operating personnel, documented in report, and replaced.

C. Post Construction On Site Service:

1. Each three months after final acceptance until warranty expires; systematically inspect, examine, clean, calibrate and adjust when necessary, gas detection system, back up power supply, transmitters, detector, panels, relays, replace defective sensors, and accessories pertaining to the system.

2. Prior to the end of the first year warranty period provide code required annual alarm operation and shutdown inspection audit with AHJ approved report and certification. Annual inspection report to include: quarterly sensor calibration and alarm setpoint reports for entire year, alarm signaling device and appliance operation matrix verification with prior year, indication of any system modifications since prior inspection, remote alarm initiating device operation, interlock operation, ventilation interlock and alarm operation, code back up power supply test sequence and report, operation of interlocks to 24 hour supervised station, etc. and as required per governing code and local AHJ. Include report for main control panels and all remote system panels. One (1) copy of annual inspection and certification information shall be turned over to the owner and one (1) copy shall be forwarded to the local municipal Fire Marshall / AHJ. Inspection certification to be posted at each system main control panel.

3. Prior to end of warranty period, provide similar service as described above complete with written report. Should a control or device be suspect in its operation or function, this deficiency shall be reported to operating personnel, documented in report, and if under warranty, replaced.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas detection devices. Refer to requirements in Division 01 Section "Demonstration and Training."

END OF SECTION 283500