

LEGAL NOTICE

Bucks County Free Library/RHJ Associates will receive bid responses until 2:00 PM on May 13, 2025.

BUCKS COUNTY FREE LIBRARY RENOVATION YARDLEY BRANCH

A Pre-Bid Meeting will be held at 9:00 AM on April 17, 2025 at the Yardley Branch, 1080 Edgewood Road, Yardley, PA 19067.

All questions must be emailed to Leigh Sheldron at sheldronl@buckslib.org and cc'd to Michael Henretty at mhenretty@rhjassoc.com by 12pm on April 24, 2025. The questions will be answered, via email, by 5pm on April 29, 2025.

A security deposit in the form of a properly executed Bid Bond for 5% of the bid amount is required. Performance and Payment Bonds are required in the amount of 100% of the contract amount. A Maintenance Bond is required in the amount of 10% of the contract. Bidders are advised Prevailing Minimum Wage Rates, determined by the Secretary of Labor and Industry, must be paid to all workers employed on this project.

A link to the solicitation may be found on the Bid page of the library website at www.buckslib.org/bids

Bids are opened publicly in the second-floor conference room of the Doylestown Library 150 S Pine St, Doylestown PA, 18901 at 2:00pm the day they are due, May 13, 2025.

INSTRUCTIONS TO BIDDERS

1. RECEIPT AND OPENING OF BIDS

- a. All sections of the Bid, including downloads and Requests for Information (RFI's) shall be submitted with the bid and acknowledges the Bidder affirms, understands, and will abide by the requirements of the Bid. Failure to do so may cause the Bid to be rejected as non-responsive.
- b. The submission of a bid will be considered as conclusive evidence of complete examination of specifications and samples.
- c. The Bucks County Free Library (BCFL) reserves the right to accept and award an Agreement to the lowest responsive, responsible bidder. BCFL reserves the right to reject any or all bids or any part thereof. BCFL reserves the right to award an Agreement based on evaluation of specific criteria found in these specifications.
- d. No verbal instructions or information to bidders will be binding. The specifications will be considered clear and complete unless written attention is called to any apparent discrepancies or incompleteness thereof before the opening of bids. Should any written inquiries be received by the BCFL, these inquiries will be answered in the form of addenda and issued to all providers. These addenda shall then be considered a part of these specifications.
- e. Each bid must be submitted electronically by 2:00 P.M. on the day of the bid opening.
- f. The bids will be opened and read publicly in the second-floor conference room of the Doylestown Library located at 150 S Pine St, Doylestown PA, by the BCFL CFO or their Representative at 2:00 P.M. on the day the bid is due.
- g. BCFL reserves the right to reject any or all bids or parts thereof, as deemed to be in the best interest of BCFL.
- h. If information is not included with your bid, and you receive a request from BCFL to provide it, you MUST deliver the information to the person making the request within 72 hours (excluding weekends). Any information not received within 72 hours may result in your bid being excluded from the evaluation and award process.
- i. BCFL is the sole authority to provide this bid package to interested companies or individuals. Bidders who are working from a bid package obtained from any other source may be working from an incomplete set of documents. BCFL assumes no responsibility for a bid's errors, omissions, or misinterpretations resulting from a Bidder's use of an incomplete bid package.
- j. Bidders who have received the bid package from a source other than BCFL are not an official vendor of record for the bid.

2. MODIFICATION AND WITHDRAWAL OF BIDS

A Bid may be modified or withdrawn via e-mail at any time up to the bid due date and time.

3. PREPARATION OF BIDS

Bidders will have been assumed to have carefully examined the Contract Documents for the work, all attached hereto, and to have carefully investigated physical conditions at the site and character of the work to be done, and to have inquired fully into the difficulties of construction of the work before preparing their bid. The OWNER will not be responsible for the failure of the Contractor to properly estimate such difficulties and costs, or for overlooking any of the requirements of the Contract Documents.

4. INTENT OF CONTRACT DOCUMENTS

The intent of the Contract Documents is to obtain a complete job, satisfactory to the ARCHITECT. It shall be understood that the bidder has satisfied themselves as to the full requirements of the Contract and has based their bid upon such understanding. Compensation for all work and materials required to complete the Contract shall be considered included in the prices bid for the items listed in the Pricing Form.

5. ADDENDA AND INTERPRETATIONS

All questions about the meaning or intent of the Bidding Documents must be emailed to Leigh Sheldon (sheldronl@buckslib.org) and Michael Henretty (mhenretty@rhjassoc.com). Interpretations or clarifications considered necessary in response to such questions will be issued through an Addendum (via e-mail). Questions received less than five (5) days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect. Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by OWNER or ARCHITECT.

Failure of any bidder to download any such addenda or interpretations shall not relieve said bidder from any obligations under this bid as submitted. All addenda so issued shall become part of the Contract Documents.

6. DISCLOSURE OF CONTENTS

All proposals/bids and other material submitted become the property of the library and may be returned only at the County's option. Information contained in the proposals/bids will not be disclosed during the evaluation process. Under Pennsylvania's "Right to Know" laws, public records are required to be open to reasonable inspection and reproduction. All proposal/bid information, including detailed price and cost information, will be held in confidence during the evaluation process and prior to the time a Notice of Award is issued. Thereafter, all proposals/bids will become public information; subject to inspection and reproduction in accordance with the PA Right to Know Law (Act 3 of 2008), unless otherwise exempt under the Act.

Notwithstanding any terms or conditions contained herein, Consultant/Vendor agrees to comply with all Local, State and Federal laws and regulations. Consultant/Vendor specifically agrees to produce all documents that may be subject to public disclosure pursuant to the Pennsylvania Open Records Law.

Trade secrets and other proprietary data contained in a proposal may be held confidential if such data meets the definitions of confidential proprietary information and/or trade secrets under Section 102 of the Right to Know Law. Material considered confidential by the offeror must be clearly identified and the offeror must include a brief statement that sets out the reasons for the confidentiality and how this information meets the criteria of Section 102 of the law.

7. CONDITIONS OF WORK

Each bidder must inform themselves fully of the conditions relating to the construction and labor under which the work will be performed; failure to do so will not relieve the successful bidder of their obligation to furnish all material and labor necessary to carry out the provisions of the

Contract Documents and to complete the contemplated work for the consideration set forth in their bid.

At the time of the opening of bids, each bidder will be presumed to have inspected physical conditions at the site and to have read and to be thoroughly familiar with the Contract Documents (including all addenda); the failure or omission of any bidder to receive or examine any form, instrument, or document shall in no way relieve any bidder from any obligation in respect to their bid.

8. TIME FOR COMPLETING WORK AND LIQUIDATED DAMAGES

The time for completion of the work under this Contract shall be (120) calendar days after formal Notice-to-Proceed from the Owner/Library.

All bidders are notified that time is of the essence for this Contract. The successful bidder will be required to prosecute the work so as to ensure its completion within the above number of calendar days set forth. It is mutually agreed that damages to the OWNER for failure of the successful bidder to fully complete the work under this Contract on or before the above-stated date shall be Two Hundred Dollars (\$200.00) for each calendar day after said date that shall elapse before the work is fully completed, which amount shall in no event be considered as a penalty, but as liquidated damages due the OWNER because of said delay. The OWNER may retain the amount thereof from any money which otherwise would be payable hereunder to the successful bidder.

In addition to the above, in order that the work may be accomplished in the shortest possible time, the successful bidder, weather permitting, shall be required to have qualified workers with designated foreman at work on-site at all times. The Contractor's personnel shall remain on-site throughout the duration of the successful bidder's work. At no time shall Contractor pull off project without the express consent of the OWNER. In addition, no change in foreman shall be permitted without approval from the OWNER. Successful bidder will be required to submit a detailed schedule for completion of work which will be subject to the review and approval of the OWNER.

9. QUALIFICATIONS OF BIDDERS

To demonstrate Bidder's qualifications to perform the Work, Bidder must submit with their Bid a complete Contractor's Qualification Statement. The bidder shall also, submit written evidence such as financial data, previous experience, present commitments, and such other data as may be reasonably requested.

10. BID SECURITY

Each bid must be accompanied by a Bid Bond, duly executed by the bidder as principal and having as surety thereon a surety company approved by the OWNER, in an amount not less than five percent (5%) of the amount of the base bid. Bid Bonds will be covered with surety of a company authorized to do business in the Commonwealth of Pennsylvania. Bid Bonds provided as surety will not be returned to the bidder after award unless bidder specifically requests the County do so. **Bids submitted with a Bid Bond must be properly signed and sealed by the Bidder and Surety Company.**

11. CONTRACT

The bidder to whom the Contract is awarded shall, within ten (10) days after the official notice of

acceptance of their bid, submit all required Bonds and Insurance to the OWNER. The time for such submittal may be extended at the election of the OWNER and for the sole benefit of the OWNER. Failure or refusal of the bidder to do so will be considered an abandonment of the Contract, and the security posted with said bid shall be forfeited to and become the property of the OWNER in an amount not to exceed the difference between the amount specified in said bid and such larger amount for which the OWNER may in good faith contract with another party to perform the work covered by said bid.

It is expressly understood and agreed by the Bidders that the contractual obligations of the Library to the Bidders are effective only after the execution of a contract signed by all parties AND the issuance of a Purchase Order by Library for the goods and/or services requested. It is further expressly understood and agreed that the mere issuance of a contract between the Library and a Bidder will not oblige the library in any fashion unless and until a Purchase Order is received by the Bidder.

12. BONDS AND INSURANCE

The successful bidder must deliver to the OWNER executed certificates of insurance as stipulated in the General Conditions or in the Supplementary Conditions and executed bonds as security for the faithful performance of his Contract and for the payment of all persons performing labor or furnishing materials in connection therewith, and for maintenance of the work for the designated period after it has been accepted by the OWNER.

The Performance and Payment Bonds shall each be in the amount of 100% of the Contract Price and the Maintenance Bond shall be in the amount of 10% of the Contract Price and shall cover a maintenance period of one year.

All bonds shall be prepared in the form of bonds attached hereto and have as security thereon such surety company or companies as are acceptable to the OWNER and as are authorized to transact business in this state. Alterations made in the terms of the Specifications, and/or quantities of work shall in no way violate the bonds.

13. BASIS OF AWARD

The Contract will be awarded on the basis of competitive bidding to the responsible bidder submitting the lowest responsive bid. The library reserves the right to award locations individually or combine locations as determined to be in our best interest.

14. REJECTION OF BIDS

The OWNER reserves the right to reject any or all bids, or to accept any bid should it deem it to be in its best interest to do so. Bids which are incomplete, conditional, or obscure, or which contain additions not called for, erasures, alterations, or irregularities of any kind, may be rejected as non-responsive. The right to reject or accept bids shall be solely for the benefit of the OWNER, and shall create no right, entitlement, or expectation in any bidder.

15. PROGRESS PAYMENTS

Refer to General Conditions for details on progress payments and retainage.

16. TRADE NAMES

Wherever trade names are used either on the Drawings or in the Specifications, it is understood that such names and designations indicate a type or kind of material and/or equipment. Approved equal in kind, type, and/or quality will be accepted at the discretion of the OWNER. The Contractor shall submit manufacturers' specifications, etc., sufficient for the ARCHITECT to determine equivalency of material and/or equipment as directed in the Instructions to Bidders, Article 23.

17. POWER OF ATTORNEY

Attorneys-in-fact who execute contract bonds must file with each bond a certified copy of their power of attorney to sign said bonds.

18. PERMITS, APPROVALS AND LICENSES

Each Contractor shall be required to determine the necessity for and obtain all necessary permits, licenses and approvals from the municipality or other public authorities and shall give all notices required by law or municipal ordinances for this work. The Contractor is solely and exclusively responsible for adherence to any existing historical, local, state, and federal codes and regulations, and all required permits, including permit costs.

19. PROGRESS SCHEDULE

Within seven (7) consecutive calendar days after the award of the Contract to them, the Contractor shall submit a proposed program of operation, showing clearly how they propose to conduct the work to bring about the completion of their work within the time limit specified. This program shall outline the proposed sequence of operations, the rates of progress and the dates when their work will be sufficiently finished to permit the installation of the work under other contracts. The work under this contract shall be so scheduled that as structures are completed, they can be placed in use or operation with a minimum of delay. The program shall be subject to the approval of the OWNER and shall be updated by the Contractor at any time during performance of the Contract, should the OWNER determine that the Contractor's actual progress does not correspond to that projected in the then-existing progress schedule.

20. OTHER CONTRACTS

Bidders are advised that work other than the work covered under their Contract may be in progress at the site of the work during the performance of the work covered by these documents. Accordingly, bidders are warned that coordination of construction activities at the site must be such as to avoid interference. UNDER NO CIRCUMSTANCES SHALL THE OWNER OR ARCHITECT BE HELD RESPONSIBLE TO THE CONTRACTOR FOR DELAYS OR EXTRA WORK OCCASIONED BY INTERFERENCE OF OTHER CONTRACTORS.

21. ESTIMATED QUANTITIES

The quantities given in the Pricing Form, if any, are approximate only, being given as a basis for the uniform comparison of bids, and the OWNER does not expressly or by implication warrant that the actual amount of work will correspond therewith.

22. SAFETY

It shall be the single and sole responsibility of the Contractor to ensure that its activities comply with applicable safety requirements. Neither the ARCHITECT nor the OWNER shall owe any duty under this Contract or otherwise to the Contractor or its agents, employees, or guests to inspect the work or otherwise ensure compliance by the Contractor with applicable safety requirements. No increases in the contract price or extensions in contract completion time shall be given by the OWNER as the consequence of the Contractor's failure to so comply.

23. PRODUCT SPECIFICATIONS

The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by Contractor if acceptable to the OWNER, application for such acceptance will be documented on a Substitution Request Form (Similar to CSI Form 13.1A in Appendices).

The OWNER reserves the right to reject any unspecified product or products submitted which requires changes in design, construction, or other changes which may increase the contract price for the performance of the work. The substitute or "or-equal" product submitted by the Contractor shall meet the requirements of the Specifications and shall, in all respects, be equal to the products specified by name herein. The OWNER shall be the sole judge as to the equality of the proposed alternate product.

24. SUPPLEMENTARY CONDITIONS

The bidder's attention is directed to the Supplementary Conditions of these Specifications. The Supplementary Conditions amend, and supplement portions of the General Conditions as required for this project.

25. EMPLOYMENT VERIFICATION ACT

The PA Public Works Employment Verification Act (Act 127 of 2012) will apply to this Contract. This Act requires public works contractors and subcontractors to verify employment eligibility; provides for the powers and duties of the Department of General Services; prescribes sanctions; and establishes good faith immunity under certain circumstances.

26. PAST PERFORMANCE

Any bidder who has demonstrated poor performance during either a current or previous agreement with Bucks County may be considered as an unqualified source and their bid may be rejected. Bucks County reserves the right to exercise this option as is deemed proper and/or necessary.

27. ACCESS TO ACCOUNTING RECORDS

The Contractor shall check all materials, equipment and labor entering into the Work and shall keep such full and detailed accounts as may be necessary for proper financial management under

this Agreement, and the system shall be satisfactory to the OWNER. The OWNER or its representative shall be afforded access to all the Contractor's records, books, correspondence, instructions, drawings, receipts vouchers, memoranda, and similar data relating to this contract, and the Contractor shall preserve all such records for a period of three years, or for such longer period as may be required by law, after the final payment.

28. ASSIGNMENT OF REFUND RIGHTS

The Contractor agrees to assign and transfer to the OWNER all its rights to sales and use tax which may be refunded as a result of a claim for refund or materials purchased in connection with this contract. The Contractor further agrees that it will not file a claim for refund for any sales or use tax that is the subject of this assignment.

29. CONTRACTS WITH SUBCONTRACTORS

The Contractor agrees to include the "Access to Accounting Records" and "Assignments of Refund Rights" paragraphs, in full, in any contracts with subcontractors.

30. REQUIRED ATTACHMENTS TO BID

The following documents must be delivered wither in person or by mail as attachments to the bid:

- Bid Bond (BB). Financial statement of the surety company, certified copy of Power of Attorney of person who signed the Bid Bond, and officer-signed certificate of surety company that they will provide the required bonds if bidder is awarded the Contract.
- Non-Collusion Affidavit (NCA)
- Signed Agreement

BID BOND

KNOW ALL MEN BY THESE PRESENTS, we, the undersigned, _____
_____ as Principal, and
_____ as Surety, are hereby held and firmly
bound unto Bucks County Free Library as Owner, in the penal sum of
_____ (\$ _____)

for the payment of which, well and truly to be made, we hereby jointly and severally bind
ourselves, our heirs, executors, administrators, successors, and assigns.

Signed this _____ day of _____, 20____.

The Condition of the above obligation is such that whereas the Principal has submitted to
_____ a certain Bid, attached hereto and hereby made a
part hereof, to enter into a contract in writing for:

BUCKS COUNTY FREE LIBRARY RENOVATION YARDLEY BRANCH

With this addition:

Contract # _____ - _____ Contract

NOW, THEREFORE,

- A.) If said Bid shall be rejected, or in the alternate,
- B.) If said Bid shall be accepted and the Principal shall furnish a bond for his faithful
performance of said Contract, and for the payment of all persons performing labor or
furnishing materials in connection therewith, and shall in all respects perform the
agreement created by the acceptance of said Bid,

Then this obligation shall be void, otherwise the same shall remain in force effect; it being
expressly understood and agreed that the liability of the Surety for any and all claims hereunder
shall, in no event, exceed the penal amount of this obligation as herein stated.

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

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

(Principal)

(Surety)

BY: _____

IMPORTANT:

Surety companies executing bonds must be authorized to do business in the Commonwealth of Pennsylvania.

NON-COLLUSION AFFIDAVIT

BUCKS COUNTY FREE LIBRARY RENOVATION

YARDLEY BRANCH LIBRARY

With this addition:

Contract # _____ - _____ Contract

State of _____

County of _____

I state I am _____ of _____
(Title) (Name of Firm)

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

I state:

1. The price(s) and amount of this bid have been arrived at independently and without consultation, communication, or agreement with any other contractor, bidder, or potential bidder.
2. Neither the price(s) nor the amount of this bid, and neither the approximate price(s) nor approximate amount of this bid have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed before bid opening.
3. No attempt has been made or will be made to induce any firm or person to refrain from bidding on this contract, or to submit a bid higher than this bid, or to submit any intentionally high or non-competitive bid or other form of complementary bid.
4. The bid of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other non-competitive bid.

5. _____, its affiliates, subsidiaries, officers,
(Name of My Firm)

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

I state _____ understands and acknowledges the above
(Name of My Firm)
representations are material and important and will be relied on by the Bucks County Free
Library Board of Directors in awarding the contract(s) for which this bid is submitted.

I understand and my firm understands any misstatement in this affidavit is and shall be treated as
fraudulent concealment from Bucks County Free Library of the true facts relating to the
submission of bids for this contract.

(Name and Company Position)

Sworn to and subscribed before me this _____ day of _____, 20__

My commission Expires: _____

Notary Public: _____

INSTRUCTIONS FOR NON-COLLUSION AFFIDAVIT

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

NON-COLLUSION AFFIDAVIT

AGREEMENT

BUCKS COUNTY FREE LIBRARY RENOVATION

YARDLEY BRANCH LIBRARY

With this addition:

Contract # _____ - _____ Contract

THIS AGREEMENT made this _____ day of _____, 20____ by and between Bucks County Free Library, 150 S Pine Street, Doylestown, PA 18901, hereinafter "Library", and

hereinafter "Contractor." The Library and the Contractor in consideration of the mutual promises contained in this Agreement, and intending to be legally bound, agree as follow:

GENERAL PROVISIONS:

The Contractor shall:

- (a) have charge of and be responsible for the entire work for which they have contracted until its final completion and acceptance by the library.
- (b) be held liable for any defects which may appear in the material they have furnished or in their work for a period of one (1) year after final acceptance by the library.
- (c) be solely liable for any damage occasioned by their work to the property of the library and others; and,
- (d) upon conclusion, clean up the ground worked over.

RESPONSIBILITIES OF THE CONTRACTOR:

The Contractor agrees to pay for all materials furnished and services rendered for the performance of the Contract and any person or corporation furnishing materials or rendering services to the Contractor as though such person or corporation were expressly named herein, provided the action is brought within one (1) year after the time and cause of the action accrued.

The Contractor shall defend, indemnify and save harmless the Library and Architect, their officers, employees and agents from and against any and all claims, demands, suits, judgments, costs and expenses of any kind arising out of the work to be performed hereunder and resulting in any injury (including death) to any person or damage to any property (including loss of use) caused by any act or failure to act by the Contractor, its officers, employees, agents or guests.

AGREEMENT

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It is also agreed and understood acceptance of final payment by the Contractor shall be considered as a release in full of any claim against the library out of, or by reason of, the work done, and materials furnished under this Contract.

The Contractor shall cooperate with the library in carrying on the work, without interrupting any service to the public.

BONDS AND INSURANCE CERTIFICATES

The Contract documents are not complete until the Library has received satisfactory performance, material payment bonds executed by responsible surety companies listed to do business in the Commonwealth of Pennsylvania and acceptable to the Library; together with Certificates of Insurance in respect to the insurance required by these specifications under policies issued by companies authorized to do business in the Commonwealth of Pennsylvania and acceptable to the Library.

FAILURE TO SUPPLY PROOF OF INSURANCE SHALL CONSTITUTE MATERIAL BREACH OF THIS AGREEMENT. Remedies for such material breach include termination of agreement by Library and / or the withholding of payments by the library until such time that material breach is cured.

STARTING AND PROSECUTION OF WORK

The Bidder agrees to begin the work within seven (7) consecutive calendar days after receipt of Notice to Proceed, and to prosecute it expeditiously to a conclusion, using an adequate number of competent men, suitable equipment, and machinery at all times, and working each working day weather conditions permit.

WORK INCLUDED IN THE CONTRACT:

The Contract shall consist of furnishing all labor, superintendence, materials, equipment, tools and other facilities, and all things necessary and proper for performance of the work as shown on the Contract Drawings and as described in these Specifications (prepared by the Architect) and the Advertisement for Bid.

CONTRACT DOCUMENTS:

The Contract Documents consist of this Agreement, the General Terms of the Contract, the Contract Drawings, the Specifications, all Addenda issued prior to bidding and all modifications issued after execution of this Agreement. These form the Contract, and all are as fully a part of the Contract if attached to this Agreement or repeated herein. The library shall furnish the Contractor up to three (3) copies of the Contract Documents for completion of the work.

MATERIALS TO BE FURNISHED BY THE LIBRARY:

No materials shall be furnished by the library.

AGREEMENT

WORK DONE BY THE LIBRARY:

No work shall be done by the library in connection with this Contract.

PAYMENTS:

In consideration of the Contractor faithfully complying with the terms and stipulations of the Contract, the Library covenants and agrees to pay said Contractor the sum set forth in the bid of said Contractor, and also pay for extra work that may be agreed upon in writing and said prices shall be full compensation under the terms of the Contract.

APPLICABLE LAW:

This Agreement shall be governed by and interpreted and enforced in accordance with the laws of the Commonwealth of Pennsylvania (without regard to any conflict of law's provisions) and the decisions of the Pennsylvania courts. The Supplier consents to the venue and jurisdiction of the Court of Common Pleas of Bucks County in Pennsylvania, waiving any claim or defense that such forum is not convenient or proper. The Supplier agrees that any such court shall have in personal jurisdiction over it, and consents to service of process in any manner authorized by Pennsylvania law.

INTEGRATION:

The Agreement, including all referenced documents and attachments, constitutes the entire agreement between the parties. No agent, representative, employee or officer of either the Library or Supplier has authority to make, or had made, any statement, agreement or representation, oral or written, in connection with the Agreement, which in any way can be deemed to modify, add to or detract from, or otherwise change or alter its terms and conditions unless otherwise explicitly stated within the agreement. No negotiations between the parties, nor any custom or usage, shall be permitted to modify or contradict any of the terms and conditions of the Agreement. No modifications, alterations, changes, or waiver to the Agreement or any of its terms shall be valid or binding unless accomplished by a written amendment signed by both parties. All such amendments will be made pursuant to the terms of the Agreement or using the appropriate Library form.

CONTROLLING TERMS AND CONDITIONS:

The terms and conditions of this Agreement shall be the exclusive terms of agreement between the Supplier and the Library. Other terms and conditions or additional terms and conditions included or referenced in the Supplier's invoices, business forms, or other documentation shall not become part of the parties' agreement and shall be disregarded by the parties, unenforceable by the Supplier and not binding on the library.

AGREEMENT

BID PRICING:

YARDLEY BRANCH LIBRARY:

- | | |
|----------------|-----------------------|
| 1. DIVISION 02 | \$ _____ (Written) |
| | \$ _____ (Numbers) |
| 2. DIVISION 06 | \$ _____ (Written) |
| | \$ _____ (Numbers) |
| 3. DIVISION 09 | \$ _____ (Written) |
| | \$ _____ (Numbers) |
| 4. DIVISION 10 | \$ _____ (Written) |
| | \$ _____ (Numbers) |
| 5. DIVISION 21 | \$ _____ (Written) |
| | \$ _____ (Numbers) |
| 6. DIVISION 22 | \$ _____ (Written) |
| | \$ _____ (Numbers) |

AGREEMENT

7. DIVISION 23

\$ _____
(Written)

\$ _____
(Numbers)

8. DIVISION 26

\$ _____
(Written)

\$ _____
(Numbers)

9. DIVISION 27

\$ _____
(Written)

\$ _____
(Numbers)

10. DIVISION 28

\$ _____
(Written)

\$ _____
(Numbers)

TOTAL AMOUNT OF BID:

\$ _____
(Written)

\$ _____
(Numbers)

AGREEMENT

IN WITNESS WHEREOF: The parties hereto have caused the signature of their proper officers and seals to be affixed thereto:

ATTEST:

_____ BY: _____

ATTEST:

_____ BY: _____
Contractor

DATE: _____

Note: An executed copy of this Agreement shall be provided with the Bid.

AGREEMENT

PAYMENT BOND

KNOWN ALL MEN, we _____, as
Principal, and _____ as
Surety, are held and firmly bound unto Bucks County Free Library, 150 S Pine Street,
Doylestown, PA 18901 and its successors and assigns (hereinafter called the Obligee), in
the just sum of:

_____ (\$_____)

Written

Figures

Lawful money of the United States of America, for the payment of which sum truly to be
made we bind ourselves and each of our respective heirs, personal representatives,
successors and assigns joints and severally by these presents, this _____ day of
_____, 20_____.

WHEREAS, the Principal has entered into a written Agreement with the Obligee, dated
_____, _____, 20_____ for performance of the Contract work in
connection with the **“BUCKS COUNTY FREE LIBRARY RENOVATION
YARDLEY BRANCH”**

With this addition:

Contract # _____ - _____ Contract
Contract in connection with Obligee (which agreement together with the specifications
therefore, including all related drawings and documents) and such alterations as may be
made in such specifications as therein provided, are hereby made a part hereof as fully as
if set out herein, and shall together be hereinafter referred to as the “Contract”; and it was
a condition of the award of said Contract that this bond be furnished.

THEREFORE, THE CONDITIONS OF THE ABOVE OBLIGATIONS ARE:

That, if the Principal and all the Principal’s subcontractors shall promptly make payment
for all material furnished and labor supplied or performed in the prosecution of the work
under the Contract, whether or not said material or labor enter into and become
component parts of said work, then this obligation shall be void; but otherwise it shall

remain in full force, "Labor" and "materials", as used in this Bond, shall include public utility services and reasonable rentals of equipment, but only for periods when the equipment is rented is actually used at the site of the work.

The Principal and Surety, for value received, hereby agree no change, extension of time, alterations or additions to the terms of any of the Contract Documents or to the items to be provided there under nor any forbearance by either the Obligee or the Principal to the other, shall in any way affect the obligation of either of them on this bond, and they hereby waives notice of any such change, extension of time, alteration or addition.

The Principal and Surety further acknowledge and agree this Bond is furnished pursuant to requirements of the Public Works Contractors' Bond Law of 1967, solely for the protection of claimants supplying labor or material to the Principal or any of the Principal's subcontractors in the prosecution of the work under the Contract, and this Bond is subject to all provisions of said Law as fully as though said provisions were set fourth herein at length. They also agree any claimant entitled under the said Law to sue on this Bond may use a copy of this obligation, certified by the Obligee, for the purpose of establishing his, or its or their claim without requiring production in court of an executed original, and that action by one or more claimants shall not bar any subsequent or concurrent action(s) by the same or other claimant(s). However, the Obligee shall in no event be liable for payment of any costs or expenses of any claimant's suit.

Both Principal and Surety acknowledge all references herein to the Principal, in singular form, shall include plural, as may be appropriate to the Principal.

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

Principal

By: _____
Attorney-in-Fact, Surety

PERFORMANCE BOND

KNOWN ALL MEN, we _____, as
Principal, and _____ as
Surety, are held and firmly bound unto Bucks County Free Library, 150 S Pine Street,
Doylestown, PA 18901 and its successors and assigns (hereinafter called the Obligee), in
the just sum of:

_____ (\$ _____)

Written

Figures

for faithful performance of the Contract as specified below, in lawful money of the
United States of America, for the payment of which sum truly to be made, we bind
ourselves and each of our respective heirs, personal representatives, successors and
assigns, joints and severally, firmly by these presents, this _____ day of
_____, 20_____.

WHEREAS, the Principal has entered into a written Agreement with the Obligee, dated
_____, _____, 20_____ for performance of the Contract work in
connection with the **“Bucks County Free Library Renovation Yardley Branch”**

With this addition:

Contract # _____ - _____ Contract

Contract in connection with Obligee (which agreement together with the specifications
therefore, including all related drawings and documents) and such alterations as may be
made in such specifications as therein provided, are hereby made a part hereof as fully as
if set out herein, and shall together be hereinafter referred to as the “Contract”; and it was
a condition of the award of said Contract that this bond be furnished.

THEREFORE, THE CONDITIONS OF THE ABOVE OBLIGATIONS ARE:

That, if the Principal shall faithfully perform the Contract (including any alterations for
additions thereto) in accordance with the specifications and conditions of the Contract,
and satisfy all claims and demands to persons or property, or for wrongful death in the
performance thereof, and shall fully indemnify and save harmless the Obligee from any
and all costs and damage which the Obligee may suffer, and fully reimburse and repay

PERFORMANCE BOND

Bucks County Free Library Renovation Yardley Branch

the Obligee any and all outlay and expense which it may incur, by reasons of any such default, then this part of the Obligation shall be void, but otherwise it shall remain in full force.

The Surety, for value received, hereby agrees no change, extension of time, alterations or additions to the terms of any of the Contract Documents or to the items to be provided thereunder nor any forbearance by either the Obligee or the Principal to the other, shall in any way affect its obligation on this bond, and it hereby waives notice of any such change, extension of time, alteration or addition.

Both Principal and Surety acknowledge all references herein to the Principal, in singular form, shall include plural, as may be appropriate to the Principal.

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

Principal

By: _____
Attorney-in-Fact, Surety

MAINTENANCE BOND

KNOWN ALL MEN, we _____, as Principal,
and _____, as Surety, are
held and firmly bound unto Bucks County Free Library, 150 S Pine Street, Doylestown,
PA 18901 and its successors and assigns (hereinafter called the Obligee), in the just sums
of:

_____ (\$ _____)
Written Figures

for maintenance as specified below:

in lawful money of the United States of America, for the payment of which sum truly to be
made, we bind ourselves and each of our respective heirs, personal representatives,
successors and assigns joints and severally, firmly by these presents, this _____ day of
_____, 20_____.

WHEREAS, the Principal has entered into a written Agreement with the Obligee, dated as of
_____, _____, 20_____ for performance of the Contract work in
connection with the "Contract for the **"Bucks County Free Library Renovation Yardley
Branch."**

With this addition:

Contract # _____ - _____ Contract

together with the plans and specifications, therefore, (including all related drawings and
documents) and such alterations as may be made in such plans and specifications as
therein provided, are hereby made a part hereof as fully as if set out herein, and shall
together be hereinafter referred to as the "Contract"; and it was a condition of the award
of said Contract that this bond be furnished.

THEREFORE, THE CONDITIONS OF THE ABOVE OBLIGATIONS ARE:

That, if the Principal shall remedy without cost to the Obligee any defects which may
develop during a period of one (1) year from the date of completion and acceptance of the
work performed under the Contract, provided that such defects in the judgment of the
Obligee or its successor, are caused by defective or inferior materials or workmanship, then

this part of the obligation shall be void, but otherwise it shall remain in full force. However, the Principal agrees the foregoing one-year limitation shall apply to the surety only and shall not relieve the Principal of any liability otherwise provided by law or by the Contract Documents.

The Principal and Surety, for value received, hereby agrees no change, extension of time, alterations or additions to the terms of any of the Contract Documents or to the items to be provided thereunder nor any forbearance by either the Obligee or the Principal to the other, shall in any way affect the obligation of either of them on this bond, and they hereby waives notice of any such change, extension of time, alteration or addition.

Both Principal and Surety acknowledge all references herein to the Principal, in singular form, shall include plural, as may be appropriate to the Principal.

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

Principal

By: _____
Attorney-in-Fact, Surety

CONTRACTOR'S AFFIDAVIT OF PAYMENTS OF DEBTS AND CLAIMS

STATE OF: _____

COUNTY OF: _____

**CONTRACT: BUCKS COUNTY FREE LIBRARY RENOVATION YARDLEY
BRANCH**

Before me, the undersigned, a _____ (Notary Public, Justice of
the Peace, or Alderman), in and for said County and State, personally appeared

_____ (Individual, Partner, or Duly Authorized
Representative of Corporate Contractor), who, being duly sworn according to law, deposes and
says all labor, material and outstanding claims and indebtedness of whatever nature arising out of
the performance of the _____, 20__ Contract of Bucks County Free
Library, 150 S Pine Street, Doylestown, PA 18901 (Owner) with

_____ (Contractor) have been paid in full.

(Individual, Partner, or Duly Authorized Representative of Corporate Contractor)

Subscribed and Sworn to me this _____ day of _____, 20__

Notary Public: _____

My Commission Expires: _____

CONSENT OF SURETY COMPANY TO FINAL PAYMENT

In accordance with the provisions of the contract dated _____,
20__ between _____(Contractor), and Bucks
County Free Library, 150 S Pine Street, Doylestown, PA 18901 (Owner).

The _____(Name of Surety),

Surety on the Bond of _____(Contractor)

After careful examination of the books and records of said Contractor, and after receipt of Affidavit and Releases, satisfies this Company all claims for labor and materials have been satisfactorily settled, hereby approved of the final payment of said Contractor, and by these presents witnesseth payment to the Contractor of the final estimates shall not relieve the Surety Company of any of its obligations to the Bucks County Board of Commissioners for Contract of **“Bucks County Free Library Renovation Yardley Branch.”**

With this addition:

Contract # _____ - _____ Contract

as set fourth in the said Surety Company's Bond No. _____.

IN WITNESS WHEREOF, the said Surety Company has hereunto set its hand and seal
this _____ day of _____, 20__.

WITNESS:

(Name of Surety)

BY: _____

(Attorney-in-Fact)

CONTRACTOR'S AFFIDAVIT OF RELEASE OF LIENS

**PROJECT: BUCKS COUNTY FREE LIBRARY RENOVATION
YARDLEY BRANCH**

TO: Bucks County Free Library
150 S Pine Street
Doylestown, PA 18901

Contract For: _____

Contract Date: _____

State of: _____

County of: _____

The undersigned hereby certifies to the best of his 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 against any property of the Owner arising in any manner out of performance of the Contract referenced above.

EXCEPTIONS (If none, write "None". If required by the Owner, the Contractor shall furnish bond satisfactory to the Owner for each exemption.)

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release of 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: _____

Address: _____

By: _____

Subscribed and Sworn to me this _____ day of _____, 20____.

Notary Public: _____

My Commission Expires: _____

CONTRACTOR'S RELEASE OF LIENS

The undersigned, _____, hereinafter known as CONTRACTOR, for itself, its subcontractors, and all parties acting through or under it, has furnished labor, equipment and materials, for the erection and construction of certain improvements consisting of the **"Bucks County Free Library Renovation Yardley Branch."**

With this addition:

Contract # _____ - _____ Contract
for Bucks County Free Library, 150 S Pine Street, Doylestown, PA 18901, hereinafter known as OWNER, and has agreed to release all liens which he or any of them have or might have on the improvement and the property by reason of materials furnished or work performed for erecting and constructing the improvement; and

NOW, contingent upon receipt of final payment from the OWNER, the undersigned CONTRACTOR, for itself, its subcontractors and all parties acting through or under it, hereby remise, release and forever quit claim to OWNER, his heirs and assigns all liens, claims and demands which he or any of them now have or might or could have on or against the interest of OWNER in the improvement and the property for labor or materials previously or subsequently furnished for erecting and constructing the improvement; so OWNER, his heirs and assigns shall hold and enjoy the improvement and the property free and clear from all liens, claims or demands for labor or materials furnished by the undersigned CONTRACTOR, which are hereby released and discharged.

CONTRACTOR: _____

ADDRESS: _____

BY: _____

TITLE: _____

Subscribed and Sworn to me this _____ day of _____, 20____.

Notary Public: _____

My Commission Expires: _____

CONTRACTOR'S QUALIFICATION STATEMENT

(NOTE: Attach separate sheets as required.)

BUCKS COUNTY FREE LIBRARY RENOVATION YARDLEY BRANCH

The undersigned certifies under oath the truth and correctness of all statements of all answers to questions made hereinafter:

TO:

Submitted By: _____ Corporation: _____
Name: _____ Partnership: _____
Address: _____ Individual: _____
Principle Office: _____ Joint Venture: _____
Other: _____

1.0 How many years has your organization been in business as a contractor? _____

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

3.0 If a corporation, answer the following:

3.1 Date of incorporation: _____

3.2 State of incorporation: _____

3.3 President's name: _____

3.4 Vice President's name(s): _____

3.5 Secretary or Clerk's name: _____

3.6 Treasurer's name: _____

3.7 List name and address of all parties holding greater than ten percent (10%) interest in the corporation: _____

4.0 If individual or partnership, answer the following:

4.1 Date of organization: _____

4.2 BUCKS COUNTY FREE LIBRARY Name and address of all Partners: (State whether general or limited partnership):

5.0 If other than corporation or partnership, describe organization and name principals:

6.0 We normally perform _____ % of the work with our own forces. List trades below:

7.0 Have you ever failed to complete any work awarded to you? If so, note when, and why.

8.0 Has any officer or partner of your organization ever been an officer or partner of another organization that failed to complete a construction project? If so, state circumstances.

9.0 List name of project, owner, architect, contract amount, percent complete and scheduled completion of the comparable construction projects your organization has in progress on this date:

10.0 List the names of project, owner, architect, contract amount, date of completion, percent of work with own forces of the projects your organization has completed in the past two (2) years which equal at least fifty percent (50%) of the total amount Bid for the project under consideration:

11.0 List the construction experience of the principal individuals of your organization:

12.0 List the categories in which your organization is legally qualified to do business in Pennsylvania:

13.0 Trade References:

14.0 Bank References:

15.0 Name of Bonding Company and name and address of agent:

16.0 Dated at _____ this _____ day of _____, 20__.

Name of Organization: _____

By: _____

Title: _____

17.0 M _____, being duly sworn, deposes and says he/she is
the _____ of Contractor(s), and answers to the
foregoing questions and all statements herein contained are true and correct.

Subscribed and Sworn before me this _____ day of _____, 20__.

Notary Public: _____

My Commission Expires: _____

RULES AND REGULATIONS FOR OUTSIDE CONTRACTORS

PRACTICE

It is the practice of Bucks County to require outside contractors to abide by established safety rules and regulations designed to protect our personnel and facilities. The intent of this procedure is to provide sufficient information to allow our contractors to conduct business in all County facilities in a safe and professional manner.

PROCEDURE

- A. The General Services Department shall communicate the safety rules and regulations for outside contractors to the contractor or his representative prior to the beginning of work, and inform the contractor that violation of these rules and regulations by the contractor may be **grounds for cancellation of the Agreement** by the County Commissioners or the Chief Operating Officer.
- B. All threats to safety involving outside contractors must be reported to the General Services Department.
- C. Bucks County Purchasing Department or requesting department, shall send a copy of this procedure to all contractors as part of any bid or quote package issued.
- D. The contractor must notify the General Services Department by phone at 215-345-3950 before starting work at any County facility.

RULES

- A. The contractor is responsible for adherence to existing local, state and federal codes and regulations.
- B. Personal vehicles may be parked in designated areas; all parking regulations as posted must be observed.
- C. The possession of any type of weapon on county property is prohibited. The contractor shall not allow his employees to work under the influence of narcotics or intoxicating beverages.
- D. Fighting, horse-play and running are prohibited within the entire facility.
- E. Smoking is not permitted.
- F. Before starting any excavation the contractor must consult with the General Services department for all known underground utilities. The contractor is also responsible to schedule a PA one Call before starting any work. All open pits and excavated areas must be properly protected at all times. Barricades, identification signs or other warning devices must be used at these hazardous locations when no work is being performed.
- G. The treatment of injuries sustained by the contractor's employees shall be the responsibility of the contractor.
- H. Regardless of the type of fuel used, all fuel-driven machines must be shut down for refueling.
- I. Gasoline powered trucks must be equipped with a spark-arrester on tail pipe. No riders, other than the driver, are permitted on either empty or loaded trucks. Refueling must be done outside the building.

- J. Adequate and proper eye protection such as safety glasses, face shields or goggles must be properly worn at all times when work offers an eye injury exposure. Safety glasses must also be worn in any posted area requiring their use.
- K. Oily or otherwise dirty disposable wiping cloths must be deposited in closed covered containers.
- L. Housekeeping is the contractor's responsibility. Clean-up of the respective working areas must be accomplished at the end of the day or shift or more often if an unusual hazard is created.
- M. Bulk storage of flammable liquids must be kept outside of buildings. No more than one day's working supply should be inside the building at any time and they must be kept in properly labeled self-closing covered safety containers.
- N. Dunnage, binding wire, metal strapping and other types of debris must be cleaned up immediately after use and taken to designated collection areas. At no time shall scrap be permitted to remain in aisles and areas where it could become a "tripping" or a "slip and fall" hazard.
- O. Aisles, exits, walkways and fire protection equipment must be maintained free from obstruction at all times. Fire doors must not be blocked or fastened open. Wires, cables or hoses, etc. shall not pass through a doorway and prevent the fire door from closing completely.
- P. Adequate fire protection must be provided at every job site where flame and spark producing equipment is used. This equipment must be inspected by the contractor before it is used to ensure that it is in good working order. A Cutting and Welding Permit must be secured from the General Service Department before starting such work.
- Q. General Services, in conjunction with the Fire Marshal's Office shall show the contractor the various methods of transmitting fire alarms within the facility. It is the responsibility of the contractor to familiarize his employees with these methods.
- R. When welding and/or cutting are done in storage rooms, flammable liquid area and vapor degreaser areas, the flammable material must be adequately covered with flame retardant tarpaulins. While the cutting and/or welding is being done, at least one person must be stationed in the immediate area with a suitable fire extinguisher.
- S. When cutting, welding or grinding work is to be done in the immediate vicinity of county employees, adequate screen protection from flying objects must be provided.
- T. If and when it becomes necessary to use a fire extinguisher, it must be reported immediately to the General Services Department.
- U. All ladders must be substantially built, free of defects and provided with the necessary safety equipment. Extension ladders, while in use, must be securely fastened to prevent them from falling or skidding. Aluminum ladders are not permitted.
- V. Acetylene, oxygen, nitrogen and other compressed gas cylinders must be securely fastened in an upright position.
- W. Contractors must store gas cylinders in a specified location. After completion of the work, the contractor is responsible for the removal of all his gas cylinders.

- X. Any spillage, regardless of its nature, must be cleaned up immediately.
- Y. Safety guards or other devices shall not be removed from tools or equipment except for repairs and must be replaced upon completion of repair.
- Z. Scaffolds planks, ladders, ropes, ground wires, etc., shall be inspected by the contractor and replaced if they prove to be defective.
- AA. Hard hats should be worn when overhead work is being performed.
- BB. Temporary wiring must be properly insulated and substantially supported.
- CC. If work necessitates the turning off of any portion of the sprinkler systems or power, General Services Department in conjunction with the Fire marshal's Office, must be notified 24 hours prior to these systems being turned off or on.
- DD. It is the responsibility of the contractor to see that only authorized, qualified (licensed if required) personnel use power actuated (stud) tools. Adequate shields to lessen the danger of flying materials must be erected if work is done in close proximity to county employees.
- EE. It is the responsibility of the contractor's representative to familiarize himself with the building or work area layout and to instruct employees in the location of emergency exits and evacuation routes.
- FF. The contractor's employees will be permitted access only to those areas necessary for the performance of contractual work. Under no circumstances are the contractor's employees allowed to tour or roam around the facility or enter areas not necessary for the performance of their work.
- GG. "Strike anywhere" matches are not permitted.
- HH. All personnel must wear shirts with sleeves that cover the shoulders and pants that cover the entire leg to the ankle.
- II. At no time is work permitted with materials that the employee does not understand or are not aware of the hazard. The contractor is required to have Material Safety Data Sheets for all materials.

GENERAL CONDITIONS

BUCKS COUNTY FREE LIBRARY RENOVATION YARDLEY BRANCH

#2025-YAR-00

YARDLEY BRANCH LIBRARY

1080 EDGEWOOD ROAD

YARDLEY, PA 19067

1. **"OWNER" DEFINED**

Wherever the word "Owner" is used in these Specifications, it shall be understood to mean:

Bucks County Free Library
150 S Pine Street
Doylestown, PA 18901

2. **"ARCHITECT" DEFINED**

Wherever the word "ARCHITECT" is used in these Specifications, it shall be understood to mean:

RHJ Associates, 860 First Ave, Suite 9A, King of Prussia, PA 19406

3. **"CONTRACTOR" DEFINED**

Wherever the word "Contractor" is used in these Specifications, it shall be understood to mean the person, firm or corporation to whom the execution of any part of the work herein contemplated shall be awarded by the Owner.

4. **SPECIFICATIONS AND DRAWINGS -COMPREHENSIVE**

All of the contemplated installation and each and every part thereof, shall be subject to all of the requirements throughout these specifications - which the Engineer may deem pertinent. All of the installations to be furnished and all of the work to be done by the Contractor shall strictly conform to these specifications, to the general and detailed drawings made for the work and forming part thereof, and to such further drawings as may be furnished to the Contractor by the Engineer at any time during the progress of the work and prior to its entire completion.

5. **PRECEDENCE**

The Drawings and Specifications are intended to be consistent with each other, but should there be any discrepancy, the Specifications shall take precedence. Technical specifications shall take precedence over general specifications or conditions. The Contractor shall closely examine the Specifications and Drawings prior to commencing work under this Agreement and shall inform the Engineer of discrepancies therein. Except in the case of apparent clerical error or inaccuracy, the figures and notes on the Drawings shall take precedence over measurements by scale. Should the Contractor observe any apparent discrepancy between any point, line or elevation and these Specifications or the Drawings, it shall be the duty of the Contractor to immediately report same to the Engineer.

6. **SPECIFICATIONS AND DRAWINGS ON THE JOB**

The Contractor or the representatives of the Contractor shall always have on hand on the job site a copy of the

Specifications, Drawings, and approved shop drawings for ready reference of the Engineer.

7. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

Within seven (7) days after the effective date of the Agreement, the Contractor shall submit for review a preliminary schedule of shop drawing submissions.

The Contractor shall review, approve and submit, with reasonable promptness and in such sequence as to cause no delay in the work of the constructor or any separate contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents.

By approving and submitting Shop Drawings, Product Data and Samples, the Contractor represents that he has determined and verified all materials, field measurements, and field construction criteria related thereto, or will do so, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Engineer's review of Shop Drawings, Product Data or Samples, unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submission and the Engineer has reviewed the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the Engineer's review thereof.

The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the Engineer on previous submittals.

No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been reviewed by the Engineer.

8. ENGINEER'S REVIEW

The review of the Engineer of drawings or other data furnished by the Contractor shall in no way relieve the Contractor from responsibility for the correctness thereof, or for the accurate and satisfactory execution of the Contract.

9. LOCATION

The entire installation during its progress shall be accurately located in plan and elevation as shown on the Drawings, or specified or as located, staked out, marked, or otherwise directed by the Engineer. When directed to do so by the Engineer, the Contractor shall provide and have at hand on the job site, all necessary stakes, straight edges, levels, chalk lines, sounding rods, augers, and all other implements and materials which the Engineer or his representative may desire to use in the location or measurement of the work by the Contractor and in making any tests thereof. The Contractor shall furnish such man or men as the Engineer or his representative may desire to assist in laying out or measuring up all or any portions of the work of the Contractor, and in making any tests thereof.

10. STAKES AND MARKS

The Contractor shall place distinct marks at or near all points where any and all buried or concealed appliances or fittings are located, or at such other points where it may be important to preserve or which might be difficult to find without such marks. Any stakes or other marks set by the Engineer, shall be under the care of the Contractor and if any stake or any mark shall be disturbed or removed, except when authorized by the Engineer, the cost of replacing the said stake or mark shall be paid by the Contractor.

11. LEGAL REQUIREMENTS

The Contractor shall conform to all general, state and local legal requirements having to do with the installation, and shall protect and defend the Owner against any claim for any accident or damage resulting from any violation thereof by the Contractor. The Contractor shall, without additional expense to the Owner, obtain all required licenses and permits.

12. LIENS

The Contractor, for itself, its subcontractors and all parties acting through or under it, covenants and agrees that no mechanics' claims or liens shall be filed or maintained by it, them or any of them against the work and the lot of ground appurtenant thereto for or on account of the work done or materials furnished by it, them or any of them, under this Contract or otherwise, for, towards, in or about the work; and the Contractor, for itself, its subcontractors, and others under it, hereby expressly waives and relinquishes the right to have, file or maintain any mechanics' liens or claim against the work, and the lot of ground appurtenant thereto, and further agrees that this waiver of the right of lien shall be an independent covenant and shall operate and be effective as well with respect to work and labor done and materials furnished under any supplemental Contract, verbal or written, or Contract for extra work, as to work and labor done and materials furnished under this Contract. Before the final payment is made to the Contractor, he shall, if required by the Owner, furnish the Owner with a complete Release of Liens, or other acceptable evidence that all payments have been made in full for all labor and materials used in the work. In case any lien, stop notice or claim for work, labor or materials done, performed, or delivered and used in the prosecution of the work herein provided for shall be filed (whether in strictly legal form or otherwise) then, in that case, the Owner may retain from any moneys due the Contractor a sum equal to the amount of said claim or notice, until such time as the Contractor shall furnish a receipt or release there from or thereof.

13. PATENT INFRINGEMENTS

The Contractor shall protect and defend the Owner against any claim for royalty, bonus, license or other expense or cost or damage, by reason of the introduction or use of any patented invention, arrangement or appliance, whether or not included in the requirements of these Specifications or shown on the Drawings herein referred to, which invention, arrangement or appliance may enter into or form part of the permanent work, or be used in connection with the construction thereof.

14. GENERAL RISKS

The Contractor shall assume all risks whatsoever as to all damages from the natural elements, fire, flood, trespass, and from any and all other causes, and shall protect accordingly all materials both before and after installation.

15. NON-INTERFERENCE

The Contractor shall, in such manner as the Engineer may require, so arrange the execution of the work as not to unnecessarily interfere with the execution of any other work which may be in progress or with the existing system. If any part of Contractor's work depends for proper execution or results upon the work of any such other contractor or utility owner (or Owner), Contractor shall inspect and promptly report to Engineer in writing any delays, defects or deficiencies in such work that render it unavailable or unsuitable for such proper execution and results. Contractor's failure so to report will constitute an acceptance of the work as fit and proper for integration with Contractor's work except for latent or non-apparent defects and deficiencies in the other work.

If Owner contracts with others for the performance of other work on the project at the site, the person or organization who will have authority and responsibility for coordination of the activities among the

various prime contractors will be identified herein and the specific matters to be covered by such authority and responsibility will be itemized, and the extent of such authority and responsibilities will be provided herein. Unless otherwise provided herein, neither Owner nor Engineer shall have any authority or responsibility in respect of such coordination.

16. STORAGE LOCATIONS

All materials delivered for the work, or excavated or otherwise disturbed, and which are not subject to immediate removal, shall be stored or placed where and as the Engineer may direct or approve, and so as to interfere as little as possible with public or other safety and convenience, and with the simultaneous prosecution of any other work.

17. TEMPORARY PASSAGEWAYS

The Contractor shall provide and maintain such safe and adequate temporary passageways as the Engineer or other authorities may direct or approve.

18. PROTECTION OF WORK AND PROPERTY

The Contractor shall provide adequate signs, lights, barricades and other devices necessary or appropriate to warn the public of the work being performed hereunder, and shall undertake such measures necessary to prevent any injury to the public or to the property of the Owner or others. The Contractor shall not interfere with or interrupt the Owner's current operations and shall coordinate with the Owner's employees in connection therewith. The Contractor shall protect existing facilities within and/or adjacent to his work.

19. PROTECTION OF THE PUBLIC

In all cases where any of the operations of the Contractor, including the temporary storage or placing the material, appliances or plant, might endanger travel or traffic on any public highway or any other thoroughfare, or persons, animals, and vehicles, sufficient barricades shall be placed and maintained during daylight. The area so affected shall be equipped with warning devices of the types, in the numbers, and at intervals required by all applicable laws and regulations.

20. NO TRESPASS

Before entering upon or in any way disturbing any public, corporation or private property, the Contractor shall give sufficient notice to the responsible official or to the Owner thereof, and shall conform to all of the reasonable requirements of such official or Owner.

21. THE PROPERTY OF THE OWNER

In obtaining free of charge and making use of any materials which the Owner may permit the Contractor to so obtain from the property of the Owner, by excavation or otherwise, the Contractor shall not only conform to all requirements herein but also to all of the wishes of the Owner.

22. PROTECTION OF THE SUSPENDED WORK

During all hours of the day and night when active work is suspended, including Sundays, the Contractor shall provide such watchmen, or take such other precautions as may be necessary to prevent injurious

trespass upon, and the entire safety of all of the materials and finished work, for the protection of all of which the Contractor shall be responsible until it is finally accepted.

23. REPAIR AND RESTORATION

The Contractor shall care for, repair, restore and make good any structure or surface or things on or in any private, corporation or public property, which may in any way be disturbed, injured, or destroyed by, or in consequence of, the work of the Contractor.

24. REFUSE MATERIAL AND FINISH

The Contractor shall promptly remove, during the progress of the work, to the satisfaction of the Engineer, all false works, rubbish, and waste materials which may accumulate on any private or public property on account of the work, and the whole work and its vicinity shall be neatly finished and made clean and tidy in every particular before it will be accepted by the Owner.

25. GENERAL RESPONSIBILITY OF CONTRACTOR

To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner and Engineer and their agents and employees from and against all claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting there from, and (2) is caused in whole or in part by any negligent act or omission of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or whether or not it is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this paragraph.

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 under this paragraph 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 workers' or workmen's compensation acts, disability benefits acts or other employee benefit acts.

26. MATERIALS, PLANT AND LABOR

The Contractor shall furnish all of the materials, in the rough or finished, of whatsoever kind, which may be required or desirable to completely execute the Contract. The Contractor shall furnish all of the tools, and other working plant and construction materials and appliances, of whatsoever kind, which may be required or desirable to completely execute the Contract. The Contractor shall furnish all of the skilled and other labor which may be required or desirable to completely execute the Contract.

27. SKILLED AND LOCAL LABOR

All work shall be done by tradesmen specialty skilled in the parts of the work to which they may be assigned.

In the employment of labor, the Contractor shall give a just preference to the residents of the general neighborhood of the proposed installations, but shall not be required to continue the employment of such local labor when more efficient labor can be obtained from elsewhere. This paragraph shall not alter or abridge the Contractor's responsibility to comply with federal, state or local laws or regulations concerning the employment of resident labor or affirmative action requirements or any authority.

28. INFORMATION NOT GUARANTEED

All information relating to existing subsurface structures and/or underground facilities, pipes or other utilities is from the best sources at present available to the Owner and the Engineer. All such information and the drawings of existing construction are furnished only for the information and convenience of Contractors.

It is agreed and understood that the Owner and the Engineer do not warrant or guarantee that the subsurface structures and/or underground facilities, pipes or other utilities encountered during construction will be the same as those indicated by the information given on the Drawings or in the Specifications.

The Contractor is responsible for ascertaining the character, location, quantities, and conditions of the various materials and the work to be done. Test pits to locate utilities may be dug at the Contractor's discretion and at the Contractor's expense.

It is further agreed and understood that the Contractor will not use any of the information made available to him or obtained in any examination made by him in any manner as a basis or ground of claim or demand of any nature, against the Owner or the Engineer, arising from or by reason of any variance which may exist between the information offered and the actual materials or structures encountered during the construction work, except as may otherwise be provided for in the Contract Documents.

The Contractor shall notify the Engineer of any and all variances from the Drawings which are discovered from test pits which the Contractor chooses to dig.

29. HAULING

The Contractor shall furnish all vehicles, and drivers and other helpers which may be required for all transportation incidental to the entire work, and the Contractor shall make any roadways which may be required, and shall restore the lines of said roadways to their original condition, upon the completion of the work.

30. REJECTION OF MATERIALS OR WORKMANSHIP

All materials and workmanship may be rejected by the Engineer if, in his opinion, they do not conform, in general and in detail, to these specifications and to the drawings, or to any drawings, descriptions and samples which the Contractor may furnish, when bidding or thereafter.

31. ORDER OF EXECUTION

All of the materials shall be delivered, and all of the different parts of the work shall be executed, at the time and in the order and sequence which may be designated or approved by the Engineer.

32. CONTRACTOR TO PROMPTLY UNLOAD AND CARE FOR SHIPMENTS

As soon as any shipment, which the Contractor is required to unload, arrives at the railroad station, or elsewhere, it shall be under the care of the Contractor, who shall henceforward be responsible for its safety, and who shall be liable for any demurrage or other costs on account of failure to immediately remove from the railroad station, or other point of delivery, any shipments which may be acceptable under these Specifications.

33. EMERGENCY WORK

Should any emergency occur, which, in the opinion of the Engineer, should demand it, the execution of the Contract shall be prosecuted with extraordinary vigor, additional shifts of men shall be employed, and the work shall be accelerated as the Engineer shall require. If such acceleration causes an increase in the Contractor's cost of performance of this work the Contractor may request a Change Order in accordance with the "Changes Clause" of the Contract.

34. IN CASE OF TARDINESS

Upon the refusal, neglect or failure of the Contractor to deliver any portion of the material, or to do or complete any part of the work, when, within the time named in the Contract, the Engineer shall order the same to be delivered or completed, the Engineer may order such portion or portions of the material elsewhere, and employ such labor as he may require to do the said work, and charge the cost thereof to the account of the Contractor.

35. MATERIALS AND WORKMANSHIP

All materials, patterns, shapes, dimensions, workmanship, methods and finish, in general and in detail, shall be such as shall be ordered or approved by the Engineer, and the Engineer shall be the sole and final judge of the quality and fitness thereof.

36. INSPECTIONS AND TESTS

Contractor shall give Engineer timely notice or readiness of the work for all required inspections, tests or approvals. If laws or regulations of any public body having jurisdiction require any work (or part thereof) to specifically be inspected, tested or approved, Contractor shall assume full responsibility therefore, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection, testing or approval. Contractor shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with Owner's or Engineer's acceptance of a supplier of materials or equipment proposed to be incorporated in the work, or of materials or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the work. All inspections, tests, or approvals other than those required by laws or regulations of any public body having jurisdiction shall be performed by organizations acceptable to Owner and Contractor (or by Engineer if so specified).

If any work (including the work of others) that is to be inspected, tested or approved is covered without written concurrence it must, if requested by the Engineer, be uncovered for observation. Such uncovering shall be at Contractor's expense unless Contractor has given the Engineer timely notice of Contractor's intention to cover the same and the Engineer has not acted with reasonable promptness in response to such notice.

If Engineer considers it necessary or advisable that covered work be observed by the Engineer or inspected or tested by others, the Contractor, at the Engineer's request, shall uncover, expose or otherwise make available for inspection or testing as Engineer may require, that portion of the work in question, furnishing all necessary labor, material and equipment. If it is found that such work is defective, the Contractor shall bear all direct, indirect and consequential costs of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction (including, but not limited to fees and charges of engineers, architects, attorneys and other professionals), and Owner shall be entitled to an appropriate decrease in the contract price. If, however, such work is not found to be defective, the Contractor shall be allowed an increase in the contract price or an extension of the contract completion time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction.

The Engineer, or his representative, shall be afforded all opportunities, and all convenient facilities that may be requested to inspect and test all materials and appliances, in the shops, on the ground, or elsewhere, and the Contractor shall subject each and all of the installations to such tests as shall satisfy the Engineer that all of these specifications have been complied with, before the installations shall be eligible for final acceptance. Any or all such inspections or tests shall be for the sole benefit of the Owner and shall be for the purpose of ascertaining whether the work complies with Contract requirements as set forth herein. Such observations shall not create or constitute a duty on the part of the Engineer to the Contractor, its agents, employees or guests to perform such observations. The Contractor shall at all times be solely responsible for compliance with job safety requirements as set forth herein.

37. INSPECTION NOT ACCEPTANCE

No materials or workmanship will be considered as accepted, which may be found to be defective in manufacture, construction or execution, or deficient in any of the requirements of these specifications, in consequence of any negligence of any inspector or subordinate engineer to point out said defect or deficiency, during or subsequent to manufacture, and during the entire progress of the work; and the Contractor will be required to correct any imperfect work, remedy, and make good or replace any defective material, whenever discovered, before the final acceptance of the work and before the release of the Surety of the Contractor.

38. CONTRACTOR TO PAY FOR REPAIRS

All materials used and all plant and labor furnished for the replacing or making good of any defective materials or workmanship shall be at the expense of the Contractor, with no extra allowance therefore by the Owner.

39. REMOVAL AND REPLACEMENT OF DEFECTIVE MATERIAL

Should the Contractor fail to promptly make good, to the satisfaction of the Engineer, any defect, or fail to remove from the work any material which the Engineer shall pronounce imperfect, the Engineer may employ workmen to remedy such defect or to remove such materials, and may order such other material elsewhere as may be required to replace that which is removed, and the cost of all such labor and material shall be charged to the account of the Contractor.

40. CONTRACTOR RESPONSIBILITY FOR EMPLOYEES

The Contractor shall at all times enforce strict discipline and good order among his employees, and shall not employ any unfit person or anyone not skilled in the task assigned to him.

41. ONE YEAR'S RESPONSIBILITY

It shall be understood that the Contractor agrees to furnish such material and appliances, and to construct the whole work in such substantial and workmanlike manner that it shall be continuously stable and efficient, and the Contractor shall promptly make good, or replace, any or all parts of the materials or installation, including all details, which may be found to be unstable or defective in any particular, ordinary wear and tear excepted, for a period of guarantee of one (1) year after the whole installation has been entirely completed, tested and accepted by the Owner.

42. ONE YEAR'S RESPONSIBILITY NOTWITHSTANDING INSPECTION

The acceptance, after inspection by the Engineer, or his representative, of any portion of the work or material, shall be subject to its freedom from the exhibition of any inherent or developed defect, or any failure to conform to these Specifications, between the time of its acceptance, and the expiration of the above-named period of one (1) year.

43. ONE YEAR'S RESPONSIBILITY FOR DIMENSIONS

The acceptance by the Engineer of any of the dimensions proposed by the Contractor shall always be understood to be with the proviso, whether stated at the time of acceptance or not, that the said dimensions shall be proved to be adequate and proper at all times until the expiration of the above-named period of one (1) year.

44. EXCELLENCE OF WHOLE - WHETHER OR NOT HEREIN SPECIFIED

It is understood that these Specifications are intended to provide that all necessary and desirable materials and appliances shall be furnished by the Contractor, and that all of the same shall be of the best quality and kind, and that the whole work shall be done and entirely completed in a workmanlike and satisfactory manner, in all details, whether herein particularly specified or not.

45. EXTRA WORK

No claim shall be allowed, and no bill shall be paid for any extra work, unless said extra work shall have been done by special written agreement with the Owner entered into prior to the commencement of said work.

If prices for such extra work are not included in the unit price bid, the Contractor shall agree to furnish the necessary materials and perform such labor as extra work, and shall agree to accept in full payment therefore the actual field cost of the material and labor plus fifteen (15) percent.

46. SUBLETTING OF WORK

Assignment or subletting of the furnishing of any materials or of the execution of any part of the work shall be subject to approval by the Engineer. Unauthorized assignment or subletting of any or all the Contract by the Contractor shall constitute a material breach of this Contract.

47. AUTHORITY OF ENGINEER'S ASSISTANTS

In the absence of the Engineer, any person whom he may designate as having charge of the work, or any part thereof, shall have and exercise all the powers of the said Engineer in all matters relating to the execution of the work herein specified, and the orders of said person shall be fully observed and obeyed.

48. TERMS OF PAYMENT FOR MACHINERY UNITS

The Contractor shall receive payment in three installments of the contract price for furnishing and installing any machinery, as follows:

- A. Thirty-five (35) percent thereof upon delivery of all of the machinery at the construction site.
- B. Thirty-five (35) percent thereof when the erection, setting and connections thereof shall be entirely completed and the whole installation be finished in every particular.
- C. Thirty (30) percent thereof when the whole installation shall have been tested and is in successful operation and is ready, as herein required, for approval and acceptance by the Engineer and by the Owner.

The term machinery shall be defined for this article as meaning any equipment with rotating or reciprocating parts.

49. MONTHLY ESTIMATE

Unless otherwise expressly provided in the Contract, monthly payment will be made for all work and materials other than machinery, by the Owner to the Contractor, during the progress of the installation according to the following:

- B. Up to fifty (50) percent completion - Ninety (90) percent of the contract value rendered by the Contractor to the Owner.
- B. Fifty (50) percent completion to beneficial occupancy - Ninety-five (95) percent of the contract value rendered by the Contractor to the Owner.

Value rendered shall be determined by monthly estimates made by the Contractor and approved by the Engineer and Owner. Increasing the percentage paid at the 50% completion point will be subject to the Engineer's determination of satisfactory and diligent performance by the Contractor.

NOTE: Applications for Payment shall be submitted for review. Sample document provided in these Specifications is for reference purposes only.

When the Contract provides for the furnishing of materials only, the said estimates shall be based upon the quantity thereof which has been delivered during the preceding month.

When the Contract provides for the furnishing of labor and the furnishing and installation of materials, the said monthly estimates shall be based upon the amount of labor performed and the quantity of materials delivered to the job site (including transportation costs) during the preceding month.

50. FINAL ESTIMATES

The balance will be paid by the Owner to the Contractor upon the satisfactory completion of the Contract obligation, the filing with the Owner by the Contractor of such satisfactory Release of Liens, or other assurance as is provided for in the following paragraph, and the approval and acceptance of all materials and work contracted for, by the Engineer and by the Owner.

51. RELEASE OF LIENS

Before the work shall be finally accepted and final payment be made, the Contractor shall furnish the Owner with a complete Release of Liens, or with such other evidence as shall be entirely satisfactory to the Owner that the finished work, including all materials therein incorporated and thereunto appertaining is, and will be, entirely free from any then present or future liens or claims.

52. SPECIFICATIONS NOT PROHIBITIVE

These Specifications are issued to bidders as a guide as to what is to be required, and it is not intended to ignore manufacturers' standards and patterns, and should any bidder wish to submit a proposal for an equivalent installation, other than that generally contemplated herein, which will be guaranteed under all of the general conditions and requirements herein specified, such a proposal will receive due consideration. The Contractor shall submit manufacturer's data, etc., as required by the Engineer to permit a thorough evaluation of the proposed equivalent installation.

53. CHANGES CLAUSE

The Owner may, at any time, by written order, and without notice to the sureties, make changes in the general scope of this Contract. If such changes cause an increase or decrease in the Contractor's cost of, or time required for, performance of the Contract, an adjustment shall be made and the Contract

modified in writing accordingly. No claim by the Contractor for payment on account of any extra work shall be enforceable unless such extra work is covered by a written order signed by a duly-authorized representative of the Owner. However, nothing in this Contract shall be construed to excuse the Contractor from executing the Contract as amended.

54. TIME EXTENSIONS

The Contractor may at any time during the performance of the contract request in writing an extension of time in performance based upon delays caused by factors beyond the control of the Contractor, such factors include labor stoppages (strikes), acts of God (natural disasters, unusually unseasonable weather), delays in delivery of materials caused by factors beyond the control of material suppliers and manufacturers. Written notice of expected delay and explanation therefore shall be made within ten

(10) calendar days from the time the contractor is aware of the cause for delay, even though the expected duration or effect of delay is not yet known. As soon as possible after the impact of the delay is determined, the Contractor will submit in writing a request for extension of time for a specific number of calendar days with fully substantiated justification therefore. Such a request may entitle the Contractor to an extension of time as recommended by the Engineer and as agreed to in writing by the Owner. Time extensions granted under these provisions are solely to relieve the Contractor's liability for liquidated damages, and will not justify an increase in the cost of the work.

55. NO DAMAGES FOR DELAY

The Contractor shall not be entitled to any claim for damages on account of hindrances or delays in performance of this contract from any cause whatsoever, including acts or failures to act on the part of the Owner or Engineer or their agents, employees or servants. The Contractor acknowledges and agrees that its sole remedy for any such delay in performance shall be an extension of contract completion time in accordance with the terms of Article 54, TIME EXTENSIONS.

56. TERMINATION BY OWNER FOR CAUSE

Without prejudice to any other legal or equitable right to remedy which it would otherwise possess hereunder, or as a matter of law, the Owner shall be entitled, by giving the Contractor five (5) days prior written notice, to terminate this Contract in its entirety at any time:

- A. if the Contractor shall fail to prosecute the work, or any part thereof, with the diligence necessary to insure its progress and completion as set forth in this contract and addenda or change orders thereto, and shall fail to take such steps to remedy such default within ten (10) days after written notice thereof from Owner as Owner shall direct; or,
- B. if the Contractor shall commit a substantial default under any of the terms, provisions, conditions or covenants contained in this contract and shall fail to take such steps to remedy such default within ten (10) days after written notice thereof from the Owner as Owner shall direct.

57. TERMINATION FOR OWNER'S CONVENIENCE

The performance of the work may be terminated at any time in whole or from time to time in part, by the Owner for its convenience. Any such termination shall be affected by delivery to the Contractor of a written notice ("Notice of Termination") specifying the extent to which performance of the work is terminated and the date upon which termination becomes effective. After receipt of a Notice of Termination, and except as otherwise directed by the Owner, the Contractor shall, in good faith, and to the best of its ability, do all things necessary, in light of such notice and of such requests in implementation thereof as the Owner may make to assure the efficient, proper closeout of the terminated work (including the protection of Owner's property).

Among other things, the Contractor shall, except as otherwise directed or approved by the Owner:

- A. stop the work on the date and to the extent specified in the Notice of Termination;
- B. place no further orders or subcontracts for services, equipment or materials except as may be necessary for completion of such portion of the work as is not terminated;
- C. terminate all orders and subcontracts to the extent they relate to the performance of work terminated by the Notice of Termination;
- D. assign to Owner, in the manner and to the extent directed by it, all of the right, title and interest of the Contractor under the orders of subcontracts so terminated, in which case the Owner shall have the right to settle or pay any or all claims arising out of the termination of such orders and subcontracts;
- E. with the approval of the Owner, settle all outstanding liabilities and all claims arising out of such termination or orders and subcontracts; and
- F. deliver to the Owner, when and as directed by the Owner, all documents and all property which, if the work had been completed, the Contractor would be required to account for or deliver to the Owner, and transfer title to such property to the Owner to the extent not already transferred.

In the event of such termination, there shall be a reduction of the amount of this Contract to reflect the reduction in the work. No cost incurred after the effective date of the Notice of Termination shall be treated as a reimbursable cost unless it relates to carrying out the unterminated portion of the work or taking closeout measures.

58. WORKER'S COMPENSATION INSURANCE

The Contractor shall carry Worker's Compensation Insurance during the life of the Contract to insure his statutory liability to his employees in the State of Pennsylvania. Coverage shall include employer's liability at minimum limits as stated in the Supplemental Conditions.

59. COMPREHENSIVE GENERAL LIABILITY INSURANCE

The Contractor shall carry the Comprehensive Form of Commercial General Liability Insurance during the life of the Contract covering the risks itemized in the form of "Certificate of Insurance" provided for in this Contract. The limits shall be as stated in the Supplemental Conditions. The Certificate of Insurance shall include coverage for, but not limited to, explosion, collapse and underground hazards. Comprehensive General Liability Insurance shall be written on an "occurrence" basis. Claims made will not be accepted. The Contractor shall carry a general umbrella liability as shown in the Supplemental Conditions. The umbrella coverage shall include Commercial General Liability, Automobile Liability and Employer's Liability. Policies shall be written in the name of the Contractor, Owner and Engineer "as their respective interests may appear." The policies shall provide coverage against any loss caused by the negligence of the Owner, its officers, employers and agents, except where the loss is caused by the sole negligence of the Owner or its aforesaid representatives.

60. COMPREHENSIVE AUTOMOBILE LIABILITY INSURANCE

The Contractor shall carry the Comprehensive Form of Automobile Liability Insurance during the life of the Contract covering the risks itemized in the form of "Certificate of insurance" provided for in this Contract. The limits shall be as stated in the Supplemental Conditions and shall be combined single limit with symbol for any automobile including hired and non-owned.

61. UNEMPLOYMENT INSURANCE

The Contractor hereby agrees to accept exclusive liability for and shall hold the Owner harmless for all payroll taxes for contributions to unemployment insurance, old age pensions, or annuities, as measured by wages, salaries or other remuneration paid to employees of said Contractor.

62. BUILDER'S RISK INSURANCE

The Contractor shall insure the structures and improvements against loss or damage by Builders Risk Insurance using "all risk" form or "special form" of coverage during the progress of the work, and until final acceptance of the work by the Owner. Such insurance shall be written in completed value form for 100% of the completed value of the Contract including stored materials connected therewith, with the amount to be certified to the Contractor by the Engineer.

63. CERTIFICATE OF INSURANCE

All policies will be subject to the approval of the Owner and Engineer.

Certificates of Insurance must be executed in quintuplicate and submitted to the Engineer prior to the execution of the Agreement. Certificates of Insurance will be required of all subcontractors documenting Worker's Compensation Insurance coverage prior to performance of work on the site by subcontractors. Prime Contractors are responsible to make sure all subcontractors have adequate General Liability Insurance. The Owner shall be the certificate holder of all Certificates of Insurance and all Certificates of Insurance shall name the Owner and Engineer as named insured or additional insured. Each certificate shall contain therein or have contained in a rider attached thereto and made a part thereof, a clause to the effect that the insurer will notify the Owner in writing thirty (30) days prior to cancellation of the policy.

The Surety on all bonds and insurance shall be rated "A" or better by A.M. Best Co. and shall be licensed to conduct business in the Commonwealth of Pennsylvania.

64. SITE ACCESSIBILITY

The Contractor must provide that the representatives of the Owner, Federal Government and the State will have access to the work wherever it is in preparation or progress and that the Contractor will provide proper facilities for such access and inspection.

65. UTILITY SERVICES

Except as otherwise provided for in the specifications, reasonable amounts of water and electricity will be made available if practicable, to the Contractor from existing system outlets on the property of the Owner. Provision of all other utility requirements, including sanitary facilities, shall be the responsibility of the Contractor. If temporary service connections are necessary, they shall be the responsibility of the Contractor.

66. DOMESTIC CONSTRUCTION MATERIALS

In obtaining materials for the execution of this Contract, preference shall be given to domestic construction material by the Contractor, subcontractors, materialmen and suppliers. An unmanufactured material shall be construed as a domestic construction material if it has been mined or produced in the United States. A manufactured construction material shall be construed as a domestic construction material if it has been manufactured in the United States substantially from articles, materials or supplies mined, produced or manufactured in the United States.

In accordance with the Buy American provision in Public Law 95-217 (section 215 of public Law 92- 500 as amended) regulations and guidelines, the Contractor agrees that preference will be given to domestic construction material by the Contractor, subcontractor, materialmen, and suppliers in the performance of this Contract.

The Owner may waive the Buy American provision based upon those factors that are deemed relevant:

- A. Such use is not in the public interest or the cost is unreasonable.
- B. The available resources of the project are not sufficient to implement this provision.
- C. The articles, materials, or supplies of the class or kind to be used or the articles, materials, or supplies from which they are manufactured are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality for the particular project.

The amount of cost differential by which domestic construction material may be given preference shall generally be the sum determined by computing; up to six percent of the bid or offered price of materials of foreign origin including all cost of delivery to the construction site, including any applicable duty, whether or not accessed. Computations will normally be based on costs on the date of opening of bids or proposals.

67. STEEL PRODUCTS PROCUREMENT ACT

The Contractor shall comply with the Steel Product Procurement Act, Pennsylvania Act No. 3, 1978, including any revisions. Only steel products as defined below shall be used in performance of this Contract.

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

68. LABOREMPLOYMENTREQUIREMENTS

Contractor and all subcontractors shall observe and comply with all Federal and State laws and local ordinances that affect those engaged or employed on the project; they shall note carefully, specific legal requirements as follows, relative to the employment of all labor and mechanics required in the execution of the work on this Program.

- A. Non-Discrimination - No Contractor, subcontractor, nor any persons acting on behalf of such contractor shall by reason of age, sex, race, creed or color, discriminate against any citizen of the Commonwealth of Pennsylvania who is qualified and available to perform the work to which the Program relates. No Contractor, subcontractor nor any person on his behalf, shall in any manner discriminate against or intimidate any employee hired for the performance of work under this Contract on account of age, sex, race, creed, or color.
- B. Affirmative Action
 - (I)) The Contractor shall take Affirmative Action to ensure that applicants are employed, and that employees are treated during employment without regard to their age, race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer: recruitment or recruitment advertising: layoff or termination, rates of pay or other forms of compensation: and

selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notice to be provided by the Contracting Officer setting forth the provisions of this non-discrimination clause.

- (2) The Contractor agrees to hire local disadvantaged youth to perform unskilled tasks wherever possible. The Contractor will provide constant supervision and training so as to enable training participants to be upgraded from unskilled to skilled in all cases where there is a positive reaction to said training.
- (3) The Contractor shall comply with Federal and State Equal Opportunity Construction Contract Regulations (Executive Order 11246) in all respects. Contractors attention is specifically drawn to the equal opportunity clause and the goals and time tables for minority and female participation set forth in the rules and regulations of the Department of Labor relative there to CER 60-41.
- (4) This Contract may be canceled or terminated by the Owner and all money due or become due hereunder, shall be forfeited for a second or any subsequent violation of the terms or conditions of this portion of the Contract.

69. RE-USE OF DOCUMENTS

Neither Contractor nor any subcontractor or supplier or other person or organization performing or furnishing any of the work under a direct or indirect contract with Owner shall have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer; and they shall not re-use any of them on extensions of the project or any other project without written consent of Owner and Engineer, and specific written verification or adaptation by Engineer.

70. REQUIREMENTS OF PREVAILING WAGE ACT

The Contractor shall pay no less than the minimum wage rates determined by Secretary of Labor and Industry and attached herein, and shall comply with all conditions of the Pennsylvania Prevailing Wage Act 442 and as amended by Act 342, all Regulations issued pursuant thereto. These requirements shall be included in all sub contractual relations of the Contractor.

Each contractor and each subcontractor shall file a statement each week and a final statement at the conclusion of the work on the Contract with the contracting agency, under oath, and in form satisfactory to the Secretary, certifying that all workmen have been paid wages in strict conformity with the provisions if any wages remain unpaid to set for the amount of wages due and owing to each workman respectively.

Before final payment is made, the Contractor must submit final wage certifications from all contractors and subcontractors.

If notified by Secretary of Labor and Industry of the filing of wage claims by workmen, the Owner shall withhold from the monies due to the Contractor or subcontractor sufficient funds to pay all claims determined to be valid and when so directed by the Secretary of Labor and Industry, shall pay these monies directly to the workmen.

71. SUBSTANTIAL COMPLETION

Substantial Completion means that point at which the construction of the project is sufficiently completed, in the opinion of the Engineer and in accordance with the Contract Documents, so that the project, or specified part, can be utilized for the purposes for which it was intended.

Prior to final payment, Contractor may, in writing to Owner and Engineer, certify that the entire project or part thereof is Substantially Complete and request that Engineer issue a notice of Substantial Completion. Within a reasonable time thereafter, Owner, Contractor and Engineer shall make an inspection of the project to determine the status of completion. If Engineer does not consider the project substantially complete, he will notify Contractor in writing giving his reasons therefore. If Engineer considers the project substantially complete, he will prepare and deliver to the Owner a tentative notice of Substantial Completion which shall fix the date of Substantial Completion and the responsibilities between Owner and Contractor for maintenance, heat and utilities. There shall be attached to the notice a tentative list of items to be completed or corrected before final payment, and the notice shall fix the time within which such items shall be completed or corrected, said time to be within the contract completion time. Owner shall have seven (7) days after receipt of the tentative notice during which he may take written objection to Engineer as to any provisions of the notice or attached list. If, after considering such objections, Engineer concludes that the project is not Substantially Complete, he will within fourteen (14) days after submission of the tentative notice to Owner notify Contractor in writing stating his reasons therefore. If after consideration of Owner's objections, Engineer considers the project substantially complete, he will within said fourteen (14) days execute and deliver to Owner and Contractor a definitive notice of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the tentative notice as he believes justified after consideration of any objections from Owner. Owner shall have the right to exclude Contractor from the project after the date of Substantial Completion, but Owner shall allow Contractor reasonable access to complete or correct items on the punch list.

Prior to final payment, Owner may request Contractor in writing to permit Owner to use a specified part of the project which he believes he may use without significant interference with construction of the other parts of the project. If Contractor agrees, he will certify to Owner and Engineer that said part of the project is Substantially Complete and request Engineer to issue a notice of Substantial Completion for that part of the project. Within a reasonable time thereafter Owner, Contractor, and Engineer shall make an inspection of that part of the project to determine its status of completion. If Engineer does not consider that it is Substantially Complete, he will notify Owner and Contractor in writing giving his reasons therefore. If Engineer, Owner and Contractor consider that part of the project to be Substantially Complete, the Engineer will execute and deliver to Owner and Contractor a notice to that effect, fixing the date of Substantial Completion as to that part of the project, attaching thereto a tentative list of items to be completed or corrected before final payment and fixing the responsibility between Owner and Contractor for maintenance, heat and utilities as to that part of the project. Owner shall have the right to exclude Contractor from any part of the project which Engineer has so certified to be Substantially Complete, but Owner shall allow Contractor reasonable access to complete or correct items on the tentative list.

END OF GENERAL CONDITIONS



COMMONWEALTH OF PENNSYLVANIA

PUBLIC WORKS EMPLOYMENT VERIFICATION FORM

Date _____

Business or Organization Name (Employer) _____

Address _____

City _____ State _____ Zip Code _____

☐ Contractor ☐ Subcontractor (check one)

Contracting Public Body _____

Contract/Project No _____

Project Description _____

Project Location _____

As a contractor/subcontractor for the above referenced public works contract, I hereby affirm that as of the above date, our company is in compliance with the Public Works Employment Verification Act ('the Act') through utilization of the federal E-Verify Program (EVP) operated by the United States Department of Homeland Security. To the best of my/our knowledge, all employees hired post January 1, 2013 are authorized to work in the United States.

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

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

Authorized Representative Signature



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

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

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

| | | |
|----------|-------------------------------|----------------|
| PRODUCER | CONTACT NAME: | |
| | PHONE (A/C, No, Ext): | FAX (A/C, No): |
| INSURED | E-MAIL ADDRESS: | |
| | PRODUCER CUSTOMER ID #: | |
| | INSURER(S) AFFORDING COVERAGE | |
| | INSURER P | NAIC # |
| | INSURER B : | |
| | INSURER C : | |
| | INSURER D : | |
| | INSURER E : | |
| | INSURER F : | |

COVERAGES

CERTIFICATE NUMBER:

REVISION NUMBER:

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

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

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

When it applies, Addition Insured shall read exactly as follows- The County of Bucks, its Board of Commissioners, employees, directors, officers, departments and divisions; and Holstein White, it's employees, directors and officers shall be included as additional insured with respect to the work performed for thir Agreement: HVAC Replacement Bensalem, Doylestown and Perkasio Branch Libraries, Spec #44-10/17.

CERTIFICATE HOLDER**CANCELLATION**

County of Bucks Board of Commissioners
Attn: Office of the Controller
55 East Court Street
Doylestown, PA 18901

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.


AUTHORIZED REPRESENTATIVE

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WEEKLY PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS

☐ Contractor or ☐ Subcontractor (Please check one)

ALL INFORMATION MUST BE COMPLETED

| | | | | | | | | | | | | | | | | | | | |
|-----------------------|--|------------------|--|--|--|--|--|--|--|--|--|------------------|--|--|--|--------------------|--|--|--|
| CONTRACTOR ADDRESS | | | | SUBCONTRACTOR ADDRESS | | | |  DEPARTMENT OF LABOR & INDUSTRY <small>COMMONWEALTH OF PENNSYLVANIA</small> BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGE DIVISION 7TH & FORSTER STREETS HARRISBURG, PA 17120 1-800-932-0665 | | | | | | | | | | | |
| PAYROLL NUMBER | | WEEK ENDING DATE | | PROJECT AND LOCATION Bucks County HVAC Replacement: Bensalem, Doylestown and Perkasie Branch Libraries | | | | | | | | PROJECT SERIAL # | | | | PROJECT # 44-10/17 | | | |
| | | | | | | | | | | | | | | | | | | | |

| EMPLOYEE NAME | APPR. RATE (%) | WORK CLASSIFICATION | DAY AND DATE | | | | | | | S- TIME 0- TIME | BASE HOURLY RATE | TOTAL FRINGE BENEFITS (C=Cash) (FB=Contributions)* | TOTAL DEDUCTIONS | GROSS PAY FOR PREVAILING RATE JOB(S) | CHECK |
|---------------|----------------------|------------------------|-----------------------|--|--|--|--|--|--|--------------------------|------------------------|---|---------------------|---|-------|
| | | | | | | | | | | | | | | | |
| | | | HOURS WORKED EACH DAY | | | | | | | | | | | | |
| | | | | | | | | | | | | C: | | | |
| | | | | | | | | | | | | FB: | | | |
| | | | | | | | | | | | | C: | | | |
| | | | | | | | | | | | | FB: | | | |
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| | | | | | | | | | | | | FB: | | | |
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| | | | | | | | | | | | | FB: | | | |

*SEE REVERSE SIDE

PAGE NUMBER _____ OF _____

BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

| | |
|----------------------------|--|
| Project Name: | Yardley Library ADA family restroom renovations. |
| General Description: | Create a new ADA-compliant family restroom and renovate the staff lounge area. |
| Project Locality | Yardley |
| Awarding Agency: | Bucks County Free Library |
| Contract Award Date: | 10/15/2024 |
| Serial Number: | 24-07540 |
| Project Classification: | Building |
| Determination Date: | 8/13/2024 |
| Assigned Field Office: | Philadelphia |
| Field Office Phone Number: | (215)560-1858 |
| Toll Free Phone Number: | |
| Project County: | Bucks County |

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

| Project: 24-07540 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|--|-----------------------|------------------------|--------------------|------------------------|--------------|
| Asbestos & Insulation Workers | 6/1/2023 | | \$57.84 | \$43.36 | \$101.20 |
| Asbestos & Insulation Workers | 5/1/2024 | | \$59.37 | \$46.03 | \$105.40 |
| Boilermaker (Commercial, Institutional, and Minor Repair Work) | 1/1/2019 | | \$29.26 | \$18.48 | \$47.74 |
| Boilermaker (Commercial, Institutional, and Minor Repair Work) | 3/1/2024 | | \$36.71 | \$19.13 | \$55.84 |
| Boilermakers | 1/1/2023 | | \$51.27 | \$35.30 | \$86.57 |
| Boilermakers | 1/1/2024 | | \$52.10 | \$35.72 | \$87.82 |
| Bricklayer | 5/1/2022 | | \$46.45 | \$31.06 | \$77.51 |
| Bricklayer | 5/1/2023 | | \$47.50 | \$31.42 | \$78.92 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2023 | | \$50.57 | \$29.02 | \$79.59 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2024 | | \$52.58 | \$29.02 | \$81.60 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2025 | | \$54.59 | \$29.02 | \$83.61 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2023 | | \$43.97 | \$29.02 | \$72.99 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2024 | | \$45.72 | \$29.02 | \$74.74 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2025 | | \$47.47 | \$29.02 | \$76.49 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2023 | | \$21.99 | \$20.62 | \$42.61 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2024 | | \$22.86 | \$20.62 | \$43.48 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2025 | | \$23.74 | \$20.62 | \$44.36 |
| Carpenters | 5/1/2023 | | \$43.97 | \$29.02 | \$72.99 |
| Carpenters | 5/1/2024 | | \$45.72 | \$29.02 | \$74.74 |
| Carpenters | 5/1/2025 | | \$47.47 | \$29.02 | \$76.49 |
| Cement Finishers & Plasterers | 5/1/2022 | | \$38.57 | \$32.39 | \$70.96 |
| Cement Masons | 5/1/2023 | | \$44.20 | \$32.96 | \$77.16 |
| Cement Masons | 5/1/2024 | | \$46.70 | \$32.46 | \$79.16 |
| Dockbuilder, Pile Drivers | 5/1/2023 | | \$50.48 | \$37.99 | \$88.47 |
| Dockbuilder, Pile Drivers | 5/1/2024 | | \$52.98 | \$37.99 | \$90.97 |
| Dockbuilder, Pile Drivers | 5/1/2025 | | \$55.23 | \$37.99 | \$93.22 |
| Dockbuilder, Pile Drivers | 5/1/2026 | | \$56.98 | \$37.99 | \$94.97 |
| Dockbuilder/Pile Driver Diver | 5/1/2023 | | \$58.41 | \$41.74 | \$100.15 |
| Dockbuilder/Pile Driver Diver | 5/1/2024 | | \$61.54 | \$41.74 | \$103.28 |
| Dockbuilder/Pile Driver Diver | 5/1/2025 | | \$64.35 | \$41.74 | \$106.09 |
| Dockbuilder/Pile Driver Diver | 5/1/2026 | | \$66.54 | \$41.74 | \$108.28 |
| Dockbuilder/pile driver tender | 5/1/2023 | | \$50.48 | \$37.99 | \$88.47 |
| Dockbuilder/pile driver tender | 5/1/2024 | | \$52.98 | \$37.99 | \$90.97 |
| Dockbuilder/pile driver tender | 5/1/2025 | | \$55.23 | \$37.99 | \$93.22 |
| Dockbuilder/pile driver tender | 5/1/2026 | | \$56.98 | \$37.99 | \$94.97 |
| Drywall Finisher | 5/1/2023 | | \$38.77 | \$31.12 | \$69.89 |
| Drywall Finisher | 5/1/2024 | | \$42.25 | \$32.56 | \$74.81 |
| Electricians | 7/3/2023 | | \$55.79 | \$37.14 | \$92.93 |
| Electricians | 1/1/2024 | | \$57.03 | \$37.89 | \$94.92 |
| Electricians | 7/1/2024 | | \$58.65 | \$39.37 | \$98.02 |
| Electricians | 1/6/2025 | | \$60.05 | \$39.87 | \$99.92 |
| Electricians | 7/7/2025 | | \$61.87 | \$41.05 | \$102.92 |
| Elevator Constructor | 1/1/2023 | | \$66.21 | \$43.64 | \$109.85 |

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

| Project: 24-07540 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|--|-----------------------|------------------------|--------------------|------------------------|--------------|
| Elevator Constructor | 1/1/2024 | | \$68.97 | \$44.70 | \$113.67 |
| Floor Coverer | 5/1/2023 | | \$50.12 | \$29.21 | \$79.33 |
| Floor Coverer | 5/1/2024 | | \$52.19 | \$29.21 | \$81.40 |
| Glazier | 5/1/2023 | | \$46.68 | \$36.62 | \$83.30 |
| Glazier | 5/1/2024 | | \$48.00 | \$37.50 | \$85.50 |
| Interior Finish | 5/1/2023 | | \$34.60 | \$25.80 | \$60.40 |
| Iron Workers (Bridge, Structural, Ornamental, Precast) | 1/1/2023 | | \$50.70 | \$39.51 | \$90.21 |
| Iron Workers (Riggers) | 7/1/2023 | | \$42.53 | \$34.14 | \$76.67 |
| Iron Workers (Riggers) | 7/1/2024 | | \$44.64 | \$34.39 | \$79.03 |
| Iron Workers (Rodman/Reinforcing) | 7/1/2023 | | \$45.70 | \$34.77 | \$80.47 |
| Iron Workers (Rodman/Reinforcing) | 7/1/2024 | | \$47.70 | \$34.77 | \$82.47 |
| Laborers (Class 01 - See notes) | 5/1/2022 | | \$33.35 | \$25.65 | \$59.00 |
| Laborers (Class 01 - See notes) | 5/1/2023 | | \$34.60 | \$25.80 | \$60.40 |
| Laborers (Class 01 - See notes) | 5/1/2024 | | \$35.85 | \$26.00 | \$61.85 |
| Laborers (Class 02 - See notes) | 5/1/2022 | | \$36.70 | \$27.00 | \$63.70 |
| Laborers (Class 02 - See notes) | 5/1/2023 | | \$37.95 | \$27.30 | \$65.25 |
| Laborers (Class 02 - See notes) | 5/1/2024 | | \$39.40 | \$27.55 | \$66.95 |
| Laborers (Class 03 - See notes) | 5/1/2022 | | \$33.77 | \$25.83 | \$59.60 |
| Laborers (Class 03 - See notes) | 5/1/2023 | | \$35.02 | \$25.98 | \$61.00 |
| Laborers (Class 03 - See notes) | 5/1/2024 | | \$36.27 | \$26.18 | \$62.45 |
| Laborers (Class 04 - See notes) | 5/1/2022 | | \$33.77 | \$25.83 | \$59.60 |
| Laborers (Class 04 - See notes) | 5/1/2023 | | \$35.02 | \$25.98 | \$61.00 |
| Laborers (Class 04 - See notes) | 5/1/2024 | | \$36.27 | \$26.18 | \$62.45 |
| Laborers (Class 05 - See notes) | 5/1/2022 | | \$33.35 | \$25.65 | \$59.00 |
| Laborers (Class 05 - See notes) | 5/1/2023 | | \$34.60 | \$25.50 | \$60.10 |
| Laborers (Class 05 - See notes) | 5/1/2024 | | \$35.85 | \$26.00 | \$61.85 |
| Landscape Laborer | 5/1/2023 | | \$29.45 | \$23.98 | \$53.43 |
| Landscape Laborer | 5/1/2024 | | \$30.70 | \$24.23 | \$54.93 |
| Marble Finisher | 5/1/2022 | | \$38.27 | \$29.15 | \$67.42 |
| Marble Finisher | 5/1/2023 | | \$39.52 | \$29.30 | \$68.82 |
| Marble Mason | 5/1/2022 | | \$45.90 | \$31.20 | \$77.10 |
| Marble Mason | 5/1/2023 | | \$47.20 | \$31.95 | \$79.15 |
| Mason Tender, Cement | 5/1/2023 | | \$35.02 | \$25.98 | \$61.00 |
| Millwright | 5/1/2023 | | \$51.60 | \$35.81 | \$87.41 |
| Millwright | 5/1/2024 | | \$54.67 | \$35.81 | \$90.48 |
| Millwright | 5/1/2025 | | \$57.39 | \$35.81 | \$93.20 |
| Millwright | 5/1/2026 | | \$60.20 | \$35.81 | \$96.01 |
| Operators (Building, Class 01 - See Notes) | 5/1/2023 | | \$52.20 | \$32.81 | \$85.01 |
| Operators (Building, Class 01 - See Notes) | 5/1/2024 | | \$53.36 | \$33.65 | \$87.01 |
| Operators (Building, Class 01 - See Notes) | 5/1/2025 | | \$54.52 | \$34.49 | \$89.01 |
| Operators (Building, Class 01 - See Notes) | 5/1/2026 | | \$55.67 | \$35.34 | \$91.01 |
| Operators (Building, Class 01A - See Notes) | 5/1/2023 | | \$55.20 | \$33.70 | \$88.90 |
| Operators (Building, Class 01A - See Notes) | 5/1/2024 | | \$56.37 | \$34.53 | \$90.90 |
| Operators (Building, Class 01A - See Notes) | 5/1/2025 | | \$57.52 | \$35.38 | \$92.90 |

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

| Project: 24-07540 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|---|-----------------------|------------------------|--------------------|------------------------|--------------|
| Operators (Building, Class 01A - See Notes) | 5/1/2026 | | \$58.68 | \$36.22 | \$94.90 |
| Operators (Building, Class 02 - See Notes) | 5/1/2023 | | \$51.95 | \$32.74 | \$84.69 |
| Operators (Building, Class 02 - See Notes) | 5/1/2024 | | \$53.11 | \$33.58 | \$86.69 |
| Operators (Building, Class 02 - See Notes) | 5/1/2025 | | \$54.27 | \$34.42 | \$88.69 |
| Operators (Building, Class 02 - See Notes) | 5/1/2026 | | \$55.43 | \$35.26 | \$90.69 |
| Operators (Building, Class 02A - See Notes) | 5/1/2023 | | \$54.97 | \$33.61 | \$88.58 |
| Operators (Building, Class 02A - See Notes) | 5/1/2024 | | \$56.13 | \$34.45 | \$90.58 |
| Operators (Building, Class 02A - See Notes) | 5/1/2025 | | \$57.29 | \$35.29 | \$92.58 |
| Operators (Building, Class 02A - See Notes) | 5/1/2026 | | \$58.44 | \$36.14 | \$94.58 |
| Operators (Building, Class 03 - See Notes) | 5/1/2023 | | \$47.87 | \$31.53 | \$79.40 |
| Operators (Building, Class 03 - See Notes) | 5/1/2024 | | \$49.03 | \$32.37 | \$81.40 |
| Operators (Building, Class 03 - See Notes) | 5/1/2025 | | \$50.18 | \$33.22 | \$83.40 |
| Operators (Building, Class 03 - See Notes) | 5/1/2026 | | \$51.34 | \$34.06 | \$85.40 |
| Operators (Building, Class 04 - See Notes) | 5/1/2023 | | \$47.57 | \$31.44 | \$79.01 |
| Operators (Building, Class 04 - See Notes) | 5/1/2024 | | \$48.73 | \$32.28 | \$81.01 |
| Operators (Building, Class 04 - See Notes) | 5/1/2025 | | \$49.88 | \$33.13 | \$83.01 |
| Operators (Building, Class 04 - See Notes) | 5/1/2026 | | \$51.04 | \$33.97 | \$85.01 |
| Operators (Building, Class 05 - See Notes) | 5/1/2023 | | \$45.85 | \$30.93 | \$76.78 |
| Operators (Building, Class 05 - See Notes) | 5/1/2024 | | \$47.00 | \$31.78 | \$78.78 |
| Operators (Building, Class 05 - See Notes) | 5/1/2025 | | \$48.16 | \$32.62 | \$80.78 |
| Operators (Building, Class 05 - See Notes) | 5/1/2026 | | \$49.32 | \$33.46 | \$82.78 |
| Operators (Building, Class 06 - See Notes) | 5/1/2023 | | \$44.85 | \$30.65 | \$75.50 |
| Operators (Building, Class 06 - See Notes) | 5/1/2024 | | \$46.02 | \$31.48 | \$77.50 |
| Operators (Building, Class 06 - See Notes) | 5/1/2025 | | \$47.17 | \$32.33 | \$79.50 |
| Operators (Building, Class 06 - See Notes) | 5/1/2026 | | \$48.34 | \$33.16 | \$81.50 |
| Operators (Building, Class 07A- See Notes) | 5/1/2023 | | \$63.33 | \$37.68 | \$101.01 |
| Operators (Building, Class 07A- See Notes) | 5/1/2024 | | \$64.80 | \$38.61 | \$103.41 |
| Operators (Building, Class 07A- See Notes) | 5/1/2025 | | \$66.26 | \$39.55 | \$105.81 |
| Operators (Building, Class 07A- See Notes) | 5/1/2026 | | \$67.73 | \$40.48 | \$108.21 |
| Operators (Building, Class 07B- See Notes) | 5/1/2023 | | \$63.04 | \$37.59 | \$100.63 |
| Operators (Building, Class 07B- See Notes) | 5/1/2024 | | \$64.50 | \$38.53 | \$103.03 |
| Operators (Building, Class 07B- See Notes) | 5/1/2025 | | \$65.97 | \$39.46 | \$105.43 |
| Operators (Building, Class 07B- See Notes) | 5/1/2026 | | \$67.44 | \$40.39 | \$107.83 |
| Painters Class 1 (see notes) | 5/1/2023 | | \$42.32 | \$32.91 | \$75.23 |
| Painters Class 1 (see notes) | 5/1/2024 | | \$42.97 | \$34.11 | \$77.08 |
| Painters Class 4 (see notes) | 5/1/2023 | | \$44.41 | \$32.91 | \$77.32 |
| Painters Class 4 (see notes) | 5/1/2024 | | \$45.06 | \$34.11 | \$79.17 |
| Plasterers | 5/1/2023 | | \$39.32 | \$32.64 | \$71.96 |
| Plasterers | 5/1/2024 | | \$39.88 | \$33.08 | \$72.96 |
| plumber | 5/1/2023 | | \$64.73 | \$37.61 | \$102.34 |
| plumber | 5/1/2024 | | \$67.53 | \$38.31 | \$105.84 |
| Pointers, Caulkers, Cleaners | 5/1/2022 | | \$47.64 | \$30.06 | \$77.70 |
| Pointers, Caulkers, Cleaners | 5/1/2023 | | \$48.80 | \$30.70 | \$79.50 |
| Roofers (Composition) | 5/1/2023 | | \$42.63 | \$34.62 | \$77.25 |

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

| Project: 24-07540 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|-------------------------------------|-----------------------|------------------------|--------------------|------------------------|--------------|
| Roofers (Composition) | 5/1/2024 | | \$44.13 | \$34.77 | \$78.90 |
| Roofers (Shingle) | 5/1/2023 | | \$32.85 | \$22.10 | \$54.95 |
| Roofers (Shingle) | 5/1/2024 | | \$34.35 | \$22.20 | \$56.55 |
| Roofers (Slate & Tile) | 5/1/2023 | | \$35.85 | \$22.10 | \$57.95 |
| Roofers (Slate & Tile) | 5/1/2024 | | \$37.35 | \$22.20 | \$59.55 |
| Sheet Metal Workers | 5/1/2022 | | \$55.75 | \$47.28 | \$103.03 |
| Sheet Metal Workers | 5/1/2023 | | \$57.31 | \$48.97 | \$106.28 |
| Sheet Metal Workers | 5/1/2024 | | \$59.22 | \$50.56 | \$109.78 |
| Sign Makers and Hangars | 7/15/2022 | | \$30.54 | \$24.35 | \$54.89 |
| Sign Makers and Hangars | 7/15/2023 | | \$31.76 | \$24.63 | \$56.39 |
| Sign Makers and Hangars | 7/15/2024 | | \$32.32 | \$25.82 | \$58.14 |
| Sprinklerfitters | 1/1/2023 | | \$62.23 | \$31.99 | \$94.22 |
| Steamfitters | 5/1/2023 | | \$67.37 | \$41.99 | \$109.36 |
| Steamfitters | 5/1/2024 | | \$70.32 | \$43.09 | \$113.41 |
| Stone Masons | 5/1/2022 | | \$45.90 | \$31.20 | \$77.10 |
| Stone Masons | 5/1/2023 | | \$47.20 | \$31.95 | \$79.15 |
| Terrazzo Finisher | 5/1/2022 | | \$42.44 | \$27.71 | \$70.15 |
| Terrazzo Finisher | 5/1/2023 | | \$43.75 | \$27.86 | \$71.61 |
| Terrazzo Grinder | 5/1/2022 | | \$42.71 | \$27.71 | \$70.42 |
| Terrazzo Grinder | 5/1/2023 | | \$44.02 | \$27.86 | \$71.88 |
| Terrazzo Mechanics | 5/1/2022 | | \$48.81 | \$29.46 | \$78.27 |
| Terrazzo Mechanics | 5/1/2023 | | \$50.26 | \$29.56 | \$79.82 |
| Tile Finisher | 5/1/2022 | | \$38.27 | \$29.15 | \$67.42 |
| Tile Finisher | 5/1/2023 | | \$39.52 | \$29.30 | \$68.82 |
| Tile Setter | 5/1/2022 | | \$48.81 | \$29.46 | \$78.27 |
| Tile Setter | 5/1/2023 | | \$50.26 | \$29.56 | \$79.82 |
| Truckdriver class 1(see notes) | 5/1/2022 | | \$35.60 | \$20.74 | \$56.34 |
| Truckdriver class 1(see notes) | 5/1/2023 | | \$36.29 | \$21.55 | \$57.84 |
| Truckdriver class 1(see notes) | 5/1/2024 | | \$36.79 | \$22.54 | \$59.33 |
| Truckdriver class 2 (see notes) | 5/1/2022 | | \$35.70 | \$20.74 | \$56.44 |
| Truckdriver class 2 (see notes) | 5/1/2023 | | \$36.39 | \$21.55 | \$57.94 |
| Truckdriver class 2 (see notes) | 5/1/2024 | | \$36.89 | \$22.54 | \$59.43 |
| Window Film / Tint Installer | 6/1/2019 | | \$24.52 | \$12.08 | \$36.60 |
| Window Film / Tint Installer | 6/1/2024 | | \$26.37 | \$14.83 | \$41.20 |

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

| Project: 24-07540 - Heavy/Highway | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|--|-----------------------|------------------------|--------------------|------------------------|--------------|
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2023 | | \$63.24 | \$29.06 | \$92.30 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2024 | | \$65.19 | \$29.06 | \$94.25 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2025 | | \$67.15 | \$29.06 | \$96.21 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2026 | | \$69.10 | \$29.06 | \$98.16 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2023 | | \$54.99 | \$29.06 | \$84.05 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2024 | | \$56.69 | \$29.06 | \$85.75 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2025 | | \$58.39 | \$29.06 | \$87.45 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2026 | | \$60.09 | \$29.06 | \$89.15 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2023 | | \$43.99 | \$22.41 | \$66.40 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2024 | | \$45.35 | \$22.41 | \$67.76 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2025 | | \$46.71 | \$22.41 | \$69.12 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2026 | | \$48.07 | \$22.41 | \$70.48 |
| Carpenter | 5/1/2023 | | \$54.99 | \$29.06 | \$84.05 |
| Carpenter | 5/1/2024 | | \$56.69 | \$29.06 | \$85.75 |
| Carpenter | 5/1/2025 | | \$58.49 | \$29.06 | \$87.55 |
| Carpenter | 5/1/2026 | | \$60.19 | \$29.06 | \$89.25 |
| Cement Masons | 5/1/2023 | | \$43.20 | \$32.91 | \$76.11 |
| Dockbuilder, Pile Drivers | 5/1/2023 | | \$50.48 | \$37.99 | \$88.47 |
| Dockbuilder, Pile Drivers | 5/1/2024 | | \$52.98 | \$37.99 | \$90.97 |
| Dockbuilder, Pile Drivers | 5/1/2025 | | \$55.23 | \$37.99 | \$93.22 |
| Dockbuilder, Pile Drivers | 5/1/2026 | | \$56.98 | \$37.99 | \$94.97 |
| Dockbuilder/Pile Driver Diver | 5/1/2023 | | \$58.41 | \$41.74 | \$100.15 |
| Dockbuilder/Pile Driver Diver | 5/1/2024 | | \$61.54 | \$41.74 | \$103.28 |
| Dockbuilder/Pile Driver Diver | 5/1/2025 | | \$64.35 | \$41.74 | \$106.09 |
| Dockbuilder/Pile Driver Diver | 5/1/2026 | | \$66.54 | \$41.74 | \$108.28 |
| Dockbuilder/pile driver tender | 5/1/2023 | | \$50.48 | \$37.99 | \$88.47 |
| Dockbuilder/pile driver tender | 5/1/2024 | | \$52.98 | \$37.99 | \$90.97 |
| Dockbuilder/pile driver tender | 5/1/2025 | | \$55.23 | \$37.99 | \$93.22 |
| Dockbuilder/pile driver tender | 5/1/2026 | | \$56.98 | \$37.99 | \$94.97 |
| Electric Lineman | 5/29/2023 | | \$60.48 | \$32.77 | \$93.25 |
| Electric Lineman | 6/3/2024 | | \$62.07 | \$33.96 | \$96.03 |
| Iron Workers (Bridge, Structural, Ornamental, Precast) | 1/1/2023 | | \$50.70 | \$39.51 | \$90.21 |
| Iron Workers (Riggers) | 7/1/2023 | | \$42.53 | \$34.14 | \$76.67 |
| Iron Workers (Rodman/Reinforcing) | 7/1/2023 | | \$45.70 | \$34.77 | \$80.47 |
| Laborers (Class 01 - See notes) | 5/1/2022 | | \$36.30 | \$27.20 | \$63.50 |
| Laborers (Class 01 - See notes) | 5/1/2023 | | \$37.55 | \$27.45 | \$65.00 |
| Laborers (Class 01 - See notes) | 5/1/2024 | | \$38.80 | \$27.65 | \$66.45 |
| Laborers (Class 02 - See notes) | 5/1/2022 | | \$36.50 | \$27.20 | \$63.70 |
| Laborers (Class 02 - See notes) | 5/1/2023 | | \$37.75 | \$27.45 | \$65.20 |
| Laborers (Class 02 - See notes) | 5/1/2024 | | \$39.00 | \$27.65 | \$66.65 |
| Laborers (Class 03 - See notes) | 5/1/2022 | | \$36.50 | \$27.20 | \$63.70 |
| Laborers (Class 03 - See notes) | 5/1/2023 | | \$37.75 | \$27.45 | \$65.20 |
| Laborers (Class 03 - See notes) | 5/1/2024 | | \$39.00 | \$27.65 | \$66.65 |
| Laborers (Class 04 - See notes) | 5/1/2022 | | \$31.10 | \$27.20 | \$58.30 |

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

| Project: 24-07540 - Heavy/Highway | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|---|-----------------------|------------------------|--------------------|------------------------|--------------|
| Laborers (Class 04 - See notes) | 5/1/2023 | | \$32.35 | \$27.45 | \$59.80 |
| Laborers (Class 04 - See notes) | 5/1/2024 | | \$33.60 | \$27.65 | \$61.25 |
| Laborers (Class 05 - See notes) | 5/1/2022 | | \$37.15 | \$27.20 | \$64.35 |
| Laborers (Class 05 - See notes) | 5/1/2023 | | \$38.40 | \$27.45 | \$65.85 |
| Laborers (Class 05 - See notes) | 5/1/2024 | | \$39.65 | \$27.65 | \$67.30 |
| Laborers (Class 06 - See notes) | 5/1/2022 | | \$37.20 | \$27.20 | \$64.40 |
| Laborers (Class 06 - See notes) | 5/1/2023 | | \$38.40 | \$27.45 | \$65.85 |
| Laborers (Class 06 - See notes) | 5/1/2024 | | \$39.70 | \$27.65 | \$67.35 |
| Laborers (Class 07 - See notes) | 5/1/2022 | | \$37.05 | \$27.20 | \$64.25 |
| Laborers (Class 07 - See notes) | 5/1/2023 | | \$38.30 | \$27.45 | \$65.75 |
| Laborers (Class 07 - See notes) | 5/1/2024 | | \$39.55 | \$27.65 | \$67.20 |
| Laborers (Class 08 - See notes) | 5/1/2022 | | \$36.80 | \$27.20 | \$64.00 |
| Laborers (Class 08 - See notes) | 5/1/2023 | | \$38.05 | \$27.45 | \$65.50 |
| Laborers (Class 08 - See notes) | 5/1/2024 | | \$39.30 | \$27.65 | \$66.95 |
| Laborers (Class 09 - See notes) | 5/1/2022 | | \$36.65 | \$27.20 | \$63.85 |
| Laborers (Class 09 - See notes) | 5/1/2023 | | \$37.90 | \$27.45 | \$65.35 |
| Laborers (Class 09 - See notes) | 5/1/2024 | | \$39.15 | \$27.65 | \$66.80 |
| Laborers (Class 10- See notes) | 5/1/2022 | | \$36.80 | \$27.20 | \$64.00 |
| Laborers (Class 10- See notes) | 5/1/2023 | | \$38.05 | \$27.45 | \$65.50 |
| Laborers (Class 10- See notes) | 5/1/2024 | | \$39.30 | \$27.65 | \$66.95 |
| Laborers (Class 11 -See Notes) | 5/1/2022 | | \$36.70 | \$27.20 | \$63.90 |
| Laborers (Class 11 -See Notes) | 5/1/2023 | | \$37.95 | \$27.45 | \$65.40 |
| Laborers (Class 11 -See Notes) | 5/1/2024 | | \$39.20 | \$27.65 | \$66.85 |
| Laborers (Class 12 -See Notes) | 5/1/2022 | | \$38.40 | \$27.20 | \$65.60 |
| Laborers (Class 12 -See Notes) | 5/1/2023 | | \$39.65 | \$27.45 | \$67.10 |
| Laborers (Class 12 -See Notes) | 5/1/2024 | | \$40.90 | \$27.65 | \$68.55 |
| Laborers (Class 13 -See Notes) | 5/1/2022 | | \$40.43 | \$27.20 | \$67.63 |
| Laborers (Class 13 -See Notes) | 5/1/2023 | | \$41.65 | \$27.45 | \$69.10 |
| Laborers (Class 13 -See Notes) | 5/1/2024 | | \$42.93 | \$27.65 | \$70.58 |
| Laborers (Class 14 -See Notes) | 5/1/2022 | | \$36.55 | \$27.20 | \$63.75 |
| Laborers (Class 14 -See Notes) | 5/1/2023 | | \$38.25 | \$27.45 | \$65.70 |
| Laborers (Class 14 -See Notes) | 5/1/2024 | | \$39.50 | \$27.65 | \$67.15 |
| Laborers Utility (PGW ONLY) (Flagperson) | 5/1/2023 | | \$31.42 | \$19.43 | \$50.85 |
| Laborers Utility (PGW ONLY) (Flagperson) | 5/1/2024 | | \$32.67 | \$19.63 | \$52.30 |
| Laborers Utility (PGW ONLY) | 5/1/2023 | | \$38.45 | \$19.43 | \$57.88 |
| Laborers Utility (PGW ONLY) | 5/1/2024 | | \$39.70 | \$19.63 | \$59.33 |
| Landscape Laborer | 5/1/2022 | | \$27.73 | \$23.65 | \$51.38 |
| Landscape Laborer | 5/1/2023 | | \$29.03 | \$23.80 | \$52.83 |
| Landscape Laborer | 5/1/2024 | | \$30.28 | \$24.05 | \$54.33 |
| Millwright | 5/1/2023 | | \$51.60 | \$35.81 | \$87.41 |
| Millwright | 5/1/2024 | | \$54.67 | \$35.81 | \$90.48 |
| Millwright | 5/1/2025 | | \$57.39 | \$35.81 | \$93.20 |
| Millwright | 5/1/2026 | | \$60.20 | \$35.81 | \$96.01 |
| Operators Class 01 - See Notes (Building, Heavy, Highway) | 5/1/2023 | | \$52.20 | \$32.81 | \$85.01 |

BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

| Project: 24-07540 - Heavy/Highway | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|--|----------------|-----------------|-------------|-----------------|---------|
| Operators Class 01 - See Notes (Building, Heavy, Highway) | 5/1/2024 | | \$53.36 | \$33.65 | \$87.01 |
| Operators Class 01 - See Notes (Building, Heavy, Highway) | 5/1/2025 | | \$54.52 | \$34.49 | \$89.01 |
| Operators Class 01 - See Notes (Building, Heavy, Highway) | 5/1/2026 | | \$55.67 | \$35.34 | \$91.01 |
| Operators Class 01a - See Notes (Building, Heavy, Highway) | 5/1/2023 | | \$55.20 | \$33.70 | \$88.90 |
| Operators Class 01a - See Notes (Building, Heavy, Highway) | 5/1/2024 | | \$56.37 | \$34.53 | \$90.90 |
| Operators Class 01a - See Notes (Building, Heavy, Highway) | 5/1/2025 | | \$57.52 | \$35.38 | \$92.90 |
| Operators Class 01a - See Notes (Building, Heavy, Highway) | 5/1/2026 | | \$58.68 | \$36.22 | \$94.90 |
| Operators Class 02 - See Notes (Building, Heavy, Highway) | 5/1/2023 | | \$51.95 | \$32.74 | \$84.69 |
| Operators Class 02 - See Notes (Building, Heavy, Highway) | 5/1/2024 | | \$53.11 | \$33.58 | \$86.69 |
| Operators Class 02 - See Notes (Building, Heavy, Highway) | 5/1/2025 | | \$54.27 | \$34.42 | \$88.69 |
| Operators Class 02 - See Notes (Building, Heavy, Highway) | 5/1/2026 | | \$55.43 | \$35.26 | \$90.69 |
| Operators Class 02a - See Notes (Building, Heavy, Highway) | 5/1/2023 | | \$54.97 | \$33.61 | \$88.58 |
| Operators Class 02a - See Notes (Building, Heavy, Highway) | 5/1/2024 | | \$56.13 | \$34.45 | \$90.58 |
| Operators Class 02a - See Notes (Building, Heavy, Highway) | 5/1/2025 | | \$57.29 | \$35.29 | \$92.58 |
| Operators Class 02a - See Notes (Building, Heavy, Highway) | 5/1/2026 | | \$58.44 | \$36.14 | \$94.58 |
| Operators Class 03 - See Notes (Building, Heavy, Highway) | 5/1/2023 | | \$47.87 | \$31.53 | \$79.40 |
| Operators Class 03 - See Notes (Building, Heavy, Highway) | 5/1/2024 | | \$49.03 | \$32.37 | \$81.40 |
| Operators Class 03 - See Notes (Building, Heavy, Highway) | 5/1/2025 | | \$50.18 | \$33.22 | \$83.40 |
| Operators Class 03 - See Notes (Building, Heavy, Highway) | 5/1/2026 | | \$51.34 | \$34.06 | \$85.40 |
| Operators Class 04 - See Notes (Building, Heavy, Highway) | 5/1/2023 | | \$47.57 | \$31.44 | \$79.01 |
| Operators Class 04 - See Notes (Building, Heavy, Highway) | 5/1/2024 | | \$48.73 | \$32.28 | \$81.01 |
| Operators Class 04 - See Notes (Building, Heavy, Highway) | 5/1/2025 | | \$49.88 | \$33.13 | \$83.01 |
| Operators Class 04 - See Notes (Building, Heavy, Highway) | 5/1/2026 | | \$51.04 | \$33.97 | \$85.01 |
| Operators Class 05 - See Notes (Building, Heavy, Highway) | 5/1/2023 | | \$45.85 | \$30.93 | \$76.78 |
| Operators Class 05 - See Notes (Building, Heavy, Highway) | 5/1/2024 | | \$47.00 | \$31.78 | \$78.78 |
| Operators Class 05 - See Notes (Building, Heavy, Highway) | 5/1/2025 | | \$48.16 | \$32.62 | \$80.78 |
| Operators Class 05 - See Notes (Building, Heavy, Highway) | 5/1/2026 | | \$49.32 | \$33.46 | \$82.78 |

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

| Project: 24-07540 - Heavy/Highway | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|---|-----------------------|------------------------|--------------------|------------------------|--------------|
| Operators Class 06 - See Notes (Building, Heavy, Highway) | 5/1/2023 | | \$44.85 | \$30.65 | \$75.50 |
| Operators Class 06 - See Notes (Building, Heavy, Highway) | 5/1/2024 | | \$46.02 | \$31.48 | \$77.50 |
| Operators Class 06 - See Notes (Building, Heavy, Highway) | 5/1/2025 | | \$47.17 | \$32.33 | \$79.50 |
| Operators Class 06 - See Notes (Building, Heavy, Highway) | 5/1/2026 | | \$48.34 | \$33.16 | \$81.50 |
| Operators Class 07 (A) - See Notes (Building, Heavy, Highway) | 5/1/2023 | | \$63.33 | \$37.68 | \$101.01 |
| Operators Class 07 (A) - See Notes (Building, Heavy, Highway) | 5/1/2024 | | \$64.80 | \$38.61 | \$103.41 |
| Operators Class 07 (A) - See Notes (Building, Heavy, Highway) | 5/1/2025 | | \$66.26 | \$39.55 | \$105.81 |
| Operators Class 07 (A) - See Notes (Building, Heavy, Highway) | 5/1/2026 | | \$67.73 | \$40.48 | \$108.21 |
| Operators Class 07 (B) - See Notes (Building, Heavy, Highway) | 5/1/2023 | | \$63.04 | \$37.59 | \$100.63 |
| Operators Class 07 (B) - See Notes (Building, Heavy, Highway) | 5/1/2024 | | \$64.50 | \$38.53 | \$103.03 |
| Operators Class 07 (B) - See Notes (Building, Heavy, Highway) | 5/1/2025 | | \$65.97 | \$39.46 | \$105.43 |
| Operators Class 07 (B) - See Notes (Building, Heavy, Highway) | 5/1/2026 | | \$67.44 | \$40.39 | \$107.83 |
| Painters - Line Stripping | 12/1/2023 | | \$42.10 | \$27.43 | \$69.53 |
| Painters Class 2 (see notes) | 2/1/2023 | | \$48.82 | \$32.09 | \$80.91 |
| Painters Class 2 (see notes) | 2/1/2024 | | \$49.57 | \$33.34 | \$82.91 |
| Painters Class 3 (see notes) | 2/1/2023 | | \$59.78 | \$32.13 | \$91.91 |
| Painters Class 3 (see notes) | 2/1/2024 | | \$60.53 | \$33.38 | \$93.91 |
| Steamfitters (Heavy and Highway - Gas Distribution) | 5/1/2022 | | \$61.34 | \$40.28 | \$101.62 |
| Steamfitters (Heavy and Highway - Gas Distribution) | 5/1/2023 | | \$64.00 | \$41.68 | \$105.68 |
| Steamfitters (Heavy and Highway - Gas Distribution) | 5/1/2024 | | \$66.80 | \$42.93 | \$109.73 |
| Steamfitters | 5/1/2018 | | \$56.37 | \$34.39 | \$90.76 |
| Truckdriver class 1(see notes) | 5/1/2022 | | \$35.45 | \$20.74 | \$56.19 |
| Truckdriver class 1(see notes) | 5/1/2023 | | \$36.14 | \$21.55 | \$57.69 |
| Truckdriver class 1(see notes) | 5/1/2024 | | \$36.64 | \$22.54 | \$59.18 |
| Truckdriver class 2 (see notes) | 5/1/2022 | | \$35.55 | \$20.74 | \$56.29 |
| Truckdriver class 2 (see notes) | 5/1/2023 | | \$36.24 | \$21.55 | \$57.79 |
| Truckdriver class 2 (see notes) | 5/1/2024 | | \$36.74 | \$22.54 | \$59.28 |

**CONTRACT DOCUMENTS
FOR**

BUCKS COUNTY FREE LIBRARY RENOVATION YARDLEY BRANCH

**YARDLEY BRANCH LIBRARY
1080 EDGEWOOD ROAD
YARDLEY PA 19067**

#2025-YAR-00

April 4, 2025

PREPARED FOR:
Bucks County Free Library
150 S Pine Street
Doylestown, PA 18901

PREPARED BY:
RHJ Associates
860 First Ave, Suite 9A
King of Prussia, PA 19406

BUCKS COUNTY FREE LIBRARY RENOVATION YARDLEY BRANCH

**CONTRACT DOCUMENTS
FOR
BUCKS COUNTY FREE LIBRARY RENOVATION YARDLEY BRANCH**

**YARDLEY BRANCH LIBRARY
1080 EDGEWOOD ROAD
YARDLEY, PA 19067**

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260510 Electrical Demolition
260519 Low-Voltage Electrical Power Conductors and Cables
260526 Grounding and Bonding for Electrical System
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2. AIA Document G702 – Application for Payment (01290.1.3.C)
3. AIA Document G703 – Schedule of Values (01290.1.2.B.2)
4. AIA Document G710 – Supplemental Instructions (01250.1.2)
5. AIA Document G714 – Construction Change Directive (01250.1.5.A)
6. AIA Document G716 – RFI Form (01310.1.6.C)
7. CSI Form 1.5A – Subcontractor List (01310.1.3.A)
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9. CSI Log Form 13.2B – RFI Log (01310.1.6.E)
10. CSI Form 13.6A – Change Order Request (01250.1.3.B.7)
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Bucks County Free Library Renovation Yardley Branch

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SECTION 000115

LIST OF DRAWINGS

The drawings listed below accompanying this specification form a part of the contract.

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A.01 –Egress & Occupancy Plan/ADA Signage Diagrams

AD.1 – Demolition Floor Plan

AD.2 – Demolition Reflected Ceiling Plan

A.1 – Floor Plan

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A.3 – Door Schedule / Millwork Elevations/Millwork Sections

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END OF SECTION 000115

LIST OF DRAWINGS

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DOCUMENT 003100 – PROJECT INFORMATION

1.1 PROJECT INFORMATION

- A. The intent of this project is to reconfigure part of the public area space, of the Bucks County Free Library, Yardley Branch, located at 1080 Edgewood Road in Yardley, PA 19067, to accommodate a new Family Restroom and Staff Restroom.
- B. Elements to be removed as shown in the drawings and defined by the scope of work:
 - 1. Kitchen millwork
 - 2. Kitchen appliances
 - 3. Floor finishes, wall base, and ceilings
 - 4. Walls
 - 5. Doors and door hardware
 - 6. Receptacles and power
 - 7. Fire alarm devices and emergency lighting
 - 8. HVAC ducts and grills
 - 9. Plumbing fixtures
- C. Elements to be installed as shown in the drawings and defined by the scope of work:
 - 1. Kitchen millwork
 - 2. Kitchen appliances
 - 3. Floor finishes, wall base, paint, and ceilings
 - 4. Walls
 - 5. Doors and door hardware
 - 6. Receptacles and power
 - 7. Fire alarm devices and emergency lighting
 - 8. HVAC ducts and grills
 - 9. Plumbing fixtures
- D. The size of the work area is approximately 2,600 sq.ft.
- E. Expected Project start date of September 2nd, 2025

1.2 DESIGN INTENT

- A. The design intent of the work is to reconfigure an existing toilet room and locker room area located within a staff area to accommodate a larger public family toilet room and a new staff toilet room located within the staff area.

END OF DOCUMENT 003100

DOCUMENT 004130 - BID FORM

1.1 BID INFORMATION

- A. Bidder: _____.
- B. Project Name: Bucks County Free Library Renovation Yardley Branch
- C. Project Locations: Yardley Branch – 1080 Edgewood Road, Yardley PA 19067
- D. Owner: Bucks County Free Library
- E. Library Spec #2025-YAR-00
- F. A mandatory Pre-Bid Meeting will be at 9:00 AM on April 17, 2025. Meet at the Yardley Branch at 1080 Edgewood Road, Yardley, PA 19067.

1.2 CERTIFICATIONS AND BASE BID

- A. Lump Sum Base Bid (Single Prime Contract):
 - 1. The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Holstein White, Inc. and Engineer's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

Base Bid

_____ Dollars (\$_____)
Written Figures

1.3 BID GUARANTEE

- A. The undersigned Bidder shall furnish surety as specified within 10 days after a written Notice of Award, if offered within 60 days after receipt of bids, and on failure to do so agrees to forfeit to

Library the attached cash, cashier's check, certified check, U.S. money order, or bid bond, in the following amount constituting five percent (5%) of the Base Bid amount above:

_____ Dollars (\$_____).
(Written amount) (Numbers)

- B. In the event Library does not offer Notice of Award within the time limits stated above, Library will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 SUBCONTRACTORS AND SUPPLIERS

- A. List all subcontractors expected to perform work as part of this project:

1. Company: _____ Trade: _____
2. Company: _____ Trade: _____
3. Company: _____ Trade: _____
4. Company: _____ Trade: _____
5. Company: _____ Trade: _____
6. Company: _____ Trade: _____

1.5 TIME OF COMPLETION

- A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Engineer and shall fully complete the Work within 120 calendar days.

1.6 ACKNOWLEDGEMENT OF ADDENDA

- A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:
1. Addendum No. _____ Dated _____.
 2. Addendum No. _____ Dated _____.

1.7 BID SUPPLEMENTS

- A. The following supplements are a part of this Bid Form and are attached hereto.
1. Bid Bond Form
 2. Non-Collusion Affidavit
 3. Contractor's Qualification Statement

4. Proposed Schedule of Values Form
5. Verification of Performance Bond and Labor and Material Bond
6. Verification of Certificates of Insurance
7. Public Works Employment Verification Form.

1.8 CONTRACTOR'S LICENSE

- A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the Jurisdiction of the Project, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.9 SUBMISSION OF BID

Respectfully submitted this ____ day of _____, 20____.

Submitted By: _____
(Name of bidding firm or corporation)

Authorized
Signature: _____
(Handwritten signature)

Signed By: _____
(Type or print name)

Title: _____
(Owner/Partner/President/Vice President)

Witness By: _____
(Handwritten signature)

Attest: _____
(Handwritten signature)

By: _____
(Type or print name)

Title: _____
(Corporate Secretary or Assistant Secretary)

Street Address: _____

City, State, Zip _____

Phone: _____

License No.: _____

Federal ID No.: _____

(Affix Corporate Seal Here)

Note: Bids submitted with a bid bond that is not properly signed and sealed by the bidder and surety company will be rejected.

Bid responses that do not include pages 00413-1 thru 00413-4 and other items indicated above may not be considered for evaluation and award.

Bids submitted with a bid bond that is not properly signed and sealed by the bidder and Surety Company may not be considered for evaluation and award.

END OF DOCUMENT 004130

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.

1.2 GENERAL CONDITIONS

- A. The Contractor shall visit the site before they submit their proposal. They shall examine all existing conditions which affect the work. Submission of the proposal shall be considered evidence that this requirement has been fulfilled. No extra payment will be allowed for additional work made necessary by the failure to visit the site.
- B. In preparing their estimate, the Contractor shall review all of the contract documents and visit the site in order to acquaint themselves with the existing and related conditions that may, will or could affect their work. They shall be experienced, skilled and knowledgeable with this type of construction and shall be expert and proficient in the preparation of estimates and the comprehension, implementation, and interpretation of contract documents such as those prepared for this project.
- C. The Contractor by their acceptance of the contract guarantees that all work installed shall be free from all defects in workmanship and materials and that all apparatus furnished by them shall develop the capacities and characteristics specified. They further guarantee that if, during a period of one (1) year from the date of the certificate of completion and acceptance of the work, any such defects in workmanship, material or performance appear, such defects shall be remedied by them without cost to the Bucks County Free Library.
- D. The Bid Plans issued for procurement of contract are diagrammatic and indicate the general arrangement of systems. The Contractor shall provide all the work required for a complete installation. The Bid Plans are not to be scaled. The contractor is solely responsible to field verify all dimensional information.
- E. The Contractor shall give all necessary notices, obtain all permits, pay all governmental taxes, fees, and other costs in connection with their work. They shall file all necessary plans and prepare all other documents including additional detailed plans that are required for compliance with all applicable laws, ordinances, rules, and regulations.
- F. The Contractor shall be responsible for all working conditions and shall maintain a safe working environment at the job site for all employees and building occupants.

SUMMARY

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1.3 PROJECT INFORMATION

- A. Project Identification:
 - 1. Bucks County Free Library Renovation Yardley Branch
- B. Project Address:
 - 1. 1080 Edgewood Drive, Yardley, PA 19067
- C. Owner: Bucks County Free Library.
- D. Owner's Representative: John J. Doran III – Chief Financial Officer
- E. Project Architect:
 - 1. RHJ Associates, P.C.
 - a. Michael Henretty
Office: 610.377.4555 ext.102
Direct: 302.482.2269

1.4 DEFINITIONS

- A. “Owner” Defined:
 - 1. Wherever the word “Owner” is used in these specifications, it shall be understood to mean:
Bucks County Free Library
Doylestown Branch – 150 S Pine Street
Doylestown, PA 18901
- B. “Architect” Defined:
 - 1. Wherever the word “Architect” is used in these Specifications, it shall be understood to mean:
RHJ Associates, P.C.
860 First Ave, Suite 9A
King of Prussia, PA 19406
- C. “Contractor” Defined:
 - 1. Wherever the word “Contractor” is used in these Specifications, it shall be understood to mean the person, firm, or corporation to whom the execution of any part of the work herein contemplated shall be awarded by the Bucks County Free Library.
- D. “He,” “Him,” “They,” or “Them” as used in the Specifications is intended to identify the responsible party implied in each section of this Specification.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents.
- B. Type of Contract.

SUMMARY

The work will be performed under one prime contract as follows:

1. GENERAL NOTES REGARDING THE PRIME CONTRACTS.

- a. All contractors are responsible for their respective sections of work, which may include work in other sections or shown on drawings other than their respective format. All contractors must make themselves familiar with the total project and all the project documents. No additions to Contract sums will be approved for any contract where work may be shown or included as part of the Contract Documents including Drawings AND/OR the Project Specifications.
- b. There shall be no political signs or activities permissible on this project. The Owner (BUCKS COUNTY FREE LIBRARY) will hold the contractor responsible for any non-compliance acts and may be subject to back charges for each occurrence.

1.6 PROJECT COMPLETION DATE

- A. Project Completion Date: Project must be complete and fully operational within 120 days of notice to proceed.

1.7 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Limits: Confine construction operations to the areas of work indicated on the plans and as defined by the Owner's representative.
 2. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Bucks County Free Library, Library'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 by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Building Security: Contractor shall be responsible for checking in with building security each day to obtain an ID badge for each employee performing work at the facility.

- E. Contractors shall obtain clearance from Bucks County Free Library prior to commencing work in any areas of building.

1.8 COORDINATION WITH OCCUPANTS

- A. Full Bucks County Free Library Occupancy: Bucks County Free Library will occupy site, existing and adjacent building(s) during entire construction period. Cooperate with Bucks County Free Library during construction operations to minimize conflicts and facilitate County usage. Perform the Work so as not to interfere with Library's day-to-day 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 Bucks County Free Library and approval of authorities having jurisdiction.
 - 2. Notify Bucks County Free Library not less than (2) weeks prior to planned activity and confirm work 72 hours in advance of activities that will affect Library's operations. **Coordinate with and receive written permission and sign-off from Owner.**
- B. Contractors shall not proceed with any work in any area of building unless they have obtained clearance to work in that area by the Library's Representative.
- C. All Hazardous material remediation in occupied areas of the building shall occur on the weekends and be coordinated with Library's Representative.

1.9 WORK RESTRICTIONS

- A. Refer to Appendix for General Services Contractor Rules and Regulations. These rules and regulations supersede the specifications and shall be referred to in the event of conflicting information.
- B. General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- C. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7 a.m. to 5 p.m., Monday through Friday, and Weekends as coordinated with Bucks County Free Library, unless otherwise indicated.
- D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Bucks County Free Library or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Bucks County Free Library not less than two (2) weeks in advance of proposed utility interruptions and provide a detailed schedule indicating exact systems to be interrupted and expected completion time.
 - 2. Obtain Library's written permission before proceeding with utility interruptions.

SUMMARY

- E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Bucks County Free Library occupancy with Library.
 - 1. Notify Bucks County Free Library not less than two (2) days in advance of proposed disruptive operations.
 - 2. Obtain Library's written permission before proceeding with disruptive operations.
- F. Non-smoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.
- G. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
 - 2. Specification requirements are to be performed by the Contractor unless specifically stated otherwise.
- B. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Specification.

END OF SECTION 011000

SECTION 012500 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

- 1. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Engineer's Supplemental Instructions." (Refer to Appendix for sample form).

1.3 PROPOSAL REQUESTS

- A. Bucks County Free Library-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail" or forms acceptable to Architect (Refer to Appendix for sample forms).

- B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 6. Comply with requirements in Division 1 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 7. Work Change Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail" or form acceptable to Architect (Refer to Appendix for sample forms).

1.4 CHANGE ORDER PROCEDURES

1. On Library's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Bucks County Free Library and Contractor on AIA Document G701 (Refer to Appendix for sample form), or other forms acceptable to the County.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 (Refer to Appendix for sample form), or other forms acceptable to the Bucks County Free Library. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of changes in the Work. It also designates a method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

CONTRACT MODIFICATION PROCEDURES

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

END OF SECTION 012500

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Sub-schedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values coordinated with each phase of payment.
- B. Format and Content: Use Specification table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Bucks County Free Library.
 - c. Library's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.

PAYMENT PROCEDURES

2. Arrange schedule of values consistent with format of AIA Document G703 (Refer to Appendix for sample form).
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Specification table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Bucks County Free Library.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Submit Application for Payment to Architect by the 15th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

PAYMENT PROCEDURES

- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment (Refer to Appendix for sample forms).
- D. Certified Payroll: Submit certified payroll in accordance with the Pennsylvania Prevailing Wage Act. Certification shall be submitted for the work period applied. Documents shall consist of a Certified Payroll Report and a Statement of Compliance. Forms can be downloaded and/or obtained from the Pennsylvania Department of Labor and Industry.
- E. Application Preparation: Complete every entry on the form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 - 3. Retainage in the amount of 10% of the work completed shall be held back from each application for payment. At the discretion of the Bucks County Free Library and the Engineer, the retainage amount may be reduced to 5% when the project has reached 80% completion.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. County reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to County.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. List of subcontractors.
 - 2. Schedule of values.
 - 3. Contractor's construction schedule (preliminary if not final).
 - 4. Schedule of unit prices.

PAYMENT PROCEDURES

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5. Submittal schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. List of Contractor's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
 12. Certificates of insurance and insurance policies.
 13. Certified Payroll documents.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting the claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Library occupancy of designated portions of the Work.
 3. Certified Payroll documents
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. Contractor's Affidavit of Payment of Debts and Claims.
 5. Contractor's Affidavit of Release of Liens.
 6. Consent of Surety Company to Final Payment.
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Library took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.
 10. Final Certified Payroll reports.
 11. Maintenance Bond.
- K. Payment from the Bucks County Free Library will be made in 45 days after all of the appropriate documents have been approved.

END OF SECTION 012900

PAYMENT PROCEDURES

SECTION 013100 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination drawings.
 - 2. Requests for Information (RFIs).
 - 3. Project meetings.

1.2 DEFINITIONS

- A. RFI: Request from Bucks County Free Library, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A (Refer to Appendix for sample form). Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

- 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.
 - 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 to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.

- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for County and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of engineering, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans and Reflected Ceiling Plans: Show engineering and structural elements, and mechanical, plumbing, fire-protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
 - 2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Engineer.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: AIA Document G716 Software-generated form with substantially the same content as indicated above, acceptable to Engineer (Refer to Appendix for sample form).
- D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow seven (7) working days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Engineer's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.
 3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B (Refer to Appendix for sample form).
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Engineer.
 4. RFI number including RFIs that were dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Engineer's response was received.
- F. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 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 Bucks County Free Library and Engineer of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

PROJECT MANAGEMENT AND COORDINATION

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Bucks County Free Library and Engineer, within three days of the meeting.
- B. Preconstruction Conference: Engineer will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Bucks County Free Library and Engineer, but no later than 15 days after Notice to Proceed.
1. Attendees: Authorized representatives of Bucks County Free Library Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. 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 RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of record documents.
 - l. Use of the premises and existing building.
 - m. Work restrictions.
 - n. Working hours.
 - o. Library's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for moisture and mold control.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. First aid.
 - x. Security.
 - y. Progress cleaning.
 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Pre-installation Conferences: Conduct a pre-installation 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 Engineer of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Attendees: In addition to representatives of Bucks County Free Library and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
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) Status of documentation.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of proposal requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.
 - 19) Documentation of information for payment requests.
- 3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

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.

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.
- D. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Bucks County Free Library.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Five paper copies.
- B. 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.

C. Construction Schedule Updating Reports: Submit with Applications for Payment.

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.

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 final completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each library branch 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 the 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 Division 1 Section "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 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.
 3. 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 fourteen 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.
1. Use Microsoft Project, for Windows XP, Macintosh OS X operating system, or other industry accepted scheduling software capable of exporting a pdf of each schedule.

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 the date established from the contract award.
- B. Preparation: Indicate each significant construction activity separately. Identify the 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 REPORTS

- A. Biweekly Construction Reports: Prepare bi-weekly construction report recording the following information concerning events at Project site:
 1. List of subcontractors at Project site.
 2. Approximate count of personnel at Project site.
 3. Equipment at Project site.
 4. Material deliveries.
 5. Accidents.
 6. Meetings and significant decisions.
 7. Unusual events.
 8. Stoppages, delays, shortages, and losses.
 9. Orders and requests of authorities having jurisdiction.
 10. Change Orders received and implemented.
 11. Construction Change Directives received and implemented.
 12. Equipment or system tests and startups.
- 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 the 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 an 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, Library, 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 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.

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. 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.

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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 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- 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 (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
 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., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.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 return without review or discard submittals received from sources other than Contractor.
 - a. 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 subcontractors, 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, numbered consecutively.
 - 17) Submittal and transmittal distribution record.
 - 18) Remarks.
 - 19) Signature of transmitter.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations: Identify deviations from the Contract Documents on submittals.
- G. Resubmittals: Make resubmittals in the 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.

- H. 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.
- I. 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. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Action Submittals: Submit five paper copies of each submittal unless otherwise indicated. Engineer will return two copies.
 - 3. Informational Submittals: Submit five paper copies of each submittal unless otherwise indicated. Engineer will not return copies.
 - 4. Certificates and Certifications Submittals: Provide a statement that includes the 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.

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- 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. Five paper copies of Product Data unless otherwise indicated. Architect will return 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 (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
 - 3. Submit Shop Drawings in the following format:
 - a. Five opaque (bond) copies of each submittal. Architect will return 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 the 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 County'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 one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.
- 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 three sets of Samples. The engineer will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- 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. Three paper copies of product schedule or list unless otherwise indicated. Engineer will return two copies.

SUBMITTAL PROCEDURES

- F. Coordination Drawings Submittals: Comply with requirements specified in Division 1 Section "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 1 Section "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."
- K. 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 Bucks County Free Library, and other information specified.
- L. 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.
- M. 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.
- N. 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.
- O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. 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.
- R. 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.
- S. 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.

SUBMITTAL PROCEDURES

- T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- U. 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.
- V. 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.

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 the Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit 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 Engineer.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 1 Section "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

SUBMITTAL PROCEDURES

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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. The architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- 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 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

REFERENCES

- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from the publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

| | |
|--------|--|
| AA | Aluminum Association, Inc. (The) |
| AAADM | American Association of Automatic Door Manufacturers |
| AABC | Associated Air Balance Council |
| AAMA | American Architectural Manufacturers Association |
| AASHTO | American Association of State Highway and Transportation Officials |
| AATCC | American Association of Textile Chemists and Colorists |
| ABAA | Air Barrier Association of America |
| ABMA | American Bearing Manufacturers Association |
| ACI | American Concrete Institute |
| ACPA | American Concrete Pipe Association |
| AEIC | Association of Edison Illuminating Companies, Inc. (The) |
| AF&PA | American Forest & Paper Association |
| AGA | American Gas Association |
| AGC | Associated General Contractors of America (The) |
| AHA | American Hardboard Association (Now part of CPA) |
| AHAM | Association of Home Appliance Manufacturers |

REFERENCES

| | |
|----------|---|
| AI | Asphalt Institute |
| AIA | American Institute of Architects (The) |
| AISC | American Institute of Steel Construction |
| AISI | American Iron and Steel Institute |
| AITC | American Institute of Timber Construction |
| ALCA | Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network) |
| ALSC | American Lumber Standard Committee, Incorporated |
| AMCA | Air Movement and Control Association International, Inc. |
| ANSI | American National Standards Institute |
| AOSA | Association of Official Seed Analysts, Inc. |
| APA | Architectural Precast Association |
| APA | APA - The Engineered Wood Association |
| APA EWS | APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association) |
| API | American Petroleum Institute |
| ARI | Air-Conditioning & Refrigeration Institute |
| ARMA | Asphalt Roofing Manufacturers Association |
| ASCE | American Society of Civil Engineers |
| ASCE/SEI | American Society of Civil Engineers/Structural Engineering Institute (See ASCE) |
| ASHRAE | American Society of Heating, Refrigerating and Air-Conditioning Engineers |
| ASME | ASME International (American Society of Mechanical Engineers International) |
| ASSE | American Society of Sanitary Engineering |
| ASTM | ASTM International (American Society for Testing and Materials International) |
| AWCI | Association of the Wall and Ceiling Industry |

REFERENCES

| | |
|-------|--|
| AWCMA | American Window Covering Manufacturers Association (Now WCMA) |
| AWI | Architectural Woodwork Institute |
| AWPA | American Wood Protection Association (Formerly: American Wood Preservers' Association) |
| AWS | American Welding Society |
| AWWA | American Water Works Association |
| BHMA | Builders Hardware Manufacturers Association |
| BIA | Brick Industry Association (The) |
| BICSI | BICSI, Inc. |
| BIFMA | BIFMA International (Business and Institutional Furniture Manufacturer's Association International) |
| BISSC | Baking Industry Sanitation Standards Committee |
| BWF | Badminton World Federation (Formerly: IBF - International Badminton Federation) |
| CCC | Carpet Cushion Council |
| CDA | Copper Development Association |
| CEA | Canadian Electricity Association |
| CEA | Consumer Electronics Association |
| CFFA | Chemical Fabrics & Film Association, Inc. |
| CGA | Compressed Gas Association |
| CIMA | Cellulose Insulation Manufacturers Association |
| CISCA | Ceilings & Interior Systems Construction Association |
| CISPI | Cast Iron Soil Pipe Institute |
| CLFMI | Chain Link Fence Manufacturers Institute |
| CRRC | Cool Roof Rating Council |
| CPA | Composite Panel Association |

REFERENCES

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|--------------|--|
| CPPA | Corrugated Polyethylene Pipe Association |
| CRI | Carpet and Rug Institute (The) |
| CRSI | Concrete Reinforcing Steel Institute |
| CSA | Canadian Standards Association |
| CSA | CSA International (Formerly: IAS - International Approval Services) |
| CSI | Cast Stone Institute |
| CSI | Construction Specifications Institute (The) |
| CSSB | Cedar Shake & Shingle Bureau |
| CTI | Cooling Technology Institute (Formerly: Cooling Tower Institute) |
| DHI | Door and Hardware Institute |
| EIA | Electronic Industries Alliance |
| EIMA | EIFS Industry Members Association |
| EJCDC | Engineers Joint Contract Documents Committee |
| EJMA | Expansion Joint Manufacturers Association, Inc. |
| ESD | ESD Association (Electrostatic Discharge Association) |
| ETL SEMCO | Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA) |
| FIBA | Federation Internationale de Basketball (The International Basketball Federation) |
| FIVB | Federation Internationale de Volleyball (The International Volleyball Federation) |
| FM Approvals | FM Approvals LLC |
| FM Global | FM Global (Formerly: FMG - FM Global) |
| FMRC | Factory Mutual Research (Now FM Global) |
| FRSA | Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. |

REFERENCES

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|-------|---|
| FSA | Fluid Sealing Association |
| FSC | Forest Stewardship Council |
| GA | Gypsum Association |
| GANA | Glass Association of North America |
| GRI | (Part of GSI) |
| GS | Green Seal |
| GSI | Geosynthetic Institute |
| HI | Hydraulic Institute |
| HI | Hydronics Institute |
| HMMA | Hollow Metal Manufacturers Association (Part of NAAMM) |
| HPVA | Hardwood Plywood & Veneer Association |
| HPW | H. P. White Laboratory, Inc. |
| IAS | International Approval Services (Now CSA International) |
| IBF | International Badminton Federation (Now BWF) |
| ICEA | Insulated Cable Engineers Association, Inc. |
| ICRI | International Concrete Repair Institute, Inc. |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronics Engineers, Inc. (The) |
| IESNA | Illuminating Engineering Society of North America |
| IEST | Institute of Environmental Sciences and Technology |
| IGCC | Insulating Glass Certification Council |
| IGMA | Insulating Glass Manufacturers Alliance |
| ILI | Indiana Limestone Institute of America, Inc. |
| ISO | International Organization for Standardization |

REFERENCES

Available from ANSI

| | |
|-------|---|
| ISSFA | International Solid Surface Fabricators Association |
| ITS | Intertek Testing Service NA (Now ETL SEMCO) |
| ITU | International Telecommunication Union |
| KCMA | Kitchen Cabinet Manufacturers Association |
| LMA | Laminating Materials Association (Now part of CPA) |
| LPI | Lightning Protection Institute |
| MBMA | Metal Building Manufacturers Association |
| MFMA | Maple Flooring Manufacturers Association, Inc. |
| MFMA | Metal Framing Manufacturers Association, Inc. |
| MH | Material Handling (Now MHIA) |
| MHIA | Material Handling Industry of America |
| MIA | Marble Institute of America |
| MPI | Master Painters Institute |
| MSS | Manufacturers Standardization Society of The Valve and Fittings Industry Inc. |
| NAAMM | National Association of Architectural Metal Manufacturers |
| NACE | NACE International (National Association of Corrosion Engineers International) |
| NADCA | National Air Duct Cleaners Association |
| NAGWS | National Association for Girls and Women in Sport |
| NAIMA | North American Insulation Manufacturers Association |
| NBGQA | National Building Granite Quarries Association, Inc. |
| NCAA | National Collegiate Athletic Association (The) |
| NCMA | National Concrete Masonry Association |
| NCPI | National Clay Pipe Institute |

REFERENCES

| | |
|-------|---|
| NCTA | National Cable & Telecommunications Association |
| NEBB | National Environmental Balancing Bureau |
| NECA | National Electrical Contractors Association |
| NeLMA | Northeastern Lumber Manufacturers' Association |
| NEMA | National Electrical Manufacturers Association |
| NETA | International Electrical Testing Association |
| NFHS | National Federation of State High School Associations |
| NFPA | NFPA (National Fire Protection Association) |
| NFRC | National Fenestration Rating Council |
| NGA | National Glass Association |
| NHLA | National Hardwood Lumber Association |
| NLGA | National Lumber Grades Authority |
| NOFMA | NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) |
| NOMMA | National Ornamental & Miscellaneous Metals Association |
| NRCA | National Roofing Contractors Association |
| NRMCA | National Ready Mixed Concrete Association |
| NSF | NSF International (National Sanitation Foundation International) |
| NSSGA | National Stone, Sand & Gravel Association |
| NTMA | National Terrazzo & Mosaic Association, Inc. (The) |
| NTRMA | National Tile Roofing Manufacturers Association (Now TRI) |
| NWWDA | National Wood Window and Door Association (Now WDMA) |
| OPL | Omega Point Laboratories, Inc. (Now ITS) |

REFERENCES

| | |
|----------|--|
| PCI | Precast/Prestressed Concrete Institute |
| PDCA | Painting & Decorating Contractors of America |
| PDI | Plumbing & Drainage Institute |
| PGI | PVC Geomembrane Institute |
| PLANET | Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America) |
| PTI | Post-Tensioning Institute |
| RCSC | Research Council on Structural Connections |
| RFCI | Resilient Floor Covering Institute |
| RIS | Redwood Inspection Service |
| SAE | SAE International |
| SDI | Steel Deck Institute |
| SDI | Steel Door Institute |
| SEFA | Scientific Equipment and Furniture Association |
| SEI/ASCE | Structural Engineering Institute/American Society of Civil Engineers (See ASCE) |
| SGCC | Safety Glazing Certification Council |
| SIA | Security Industry Association |
| SIGMA | Sealed Insulating Glass Manufacturers Association (Now IGMA) |
| SJI | Steel Joist Institute |
| SMA | Screen Manufacturers Association |
| SMACNA | Sheet Metal and Air Conditioning Contractors' National Association |
| SMPTE | Society of Motion Picture and Television Engineers |
| SPFA | Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) |
| SPIB | Southern Pine Inspection Bureau (The) |

REFERENCES

| | |
|---------|--|
| SPRI | Single Ply Roofing Industry |
| SSINA | Specialty Steel Industry of North America |
| SSPC | SSPC: The Society for Protective Coatings |
| STI | Steel Tank Institute |
| SWI | Steel Window Institute |
| SWRI | Sealant, Waterproofing, & Restoration Institute |
| TCA | Tile Council of America, Inc. (Now TCNA) |
| TCNA | Tile Council of North America, Inc. |
| TIA/EIA | Telecommunications Industry Association/Electronic Industries Alliance |
| TMS | The Masonry Society |
| TPI | Truss Plate Institute, Inc. |
| TPI | Turfgrass Producers International |
| TRI | Tile Roofing Institute |
| UL | Underwriters Laboratories Inc. |
| UNI | Uni-Bell PVC Pipe Association |
| USAV | USA Volleyball |
| USGBC | U.S. Green Building Council |
| USITT | United States Institute for Theatre Technology, Inc. |
| WASTEC | Waste Equipment Technology Association |
| WCLIB | West Coast Lumber Inspection Bureau |
| WCMA | Window Covering Manufacturers Association |
| WCSC | Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) |
| WDMA | Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) |
| WI | Woodwork Institute (Formerly: WIC - Woodwork Institute of California) |

REFERENCES

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| | |
|-------|--|
| WIC | Woodwork Institute of California (Now WI) |
| WMMPA | Wood Moulding & Millwork Producers Association |
| WSRCA | Western States Roofing Contractors Association |
| WWPA | Western Wood Products Association |

- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up to date as of the date of the Contract Documents.

| | |
|--------|--|
| IAPMO | International Association of Plumbing and Mechanical Officials |
| ICC | International Code Council |
| ICC-ES | ICC Evaluation Service, Inc. |
| UBC | Uniform Building Code (See ICC) |

- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up to date as of the date of the Contract Documents.

| | |
|------|------------------------------------|
| CE | Army Corps of Engineers |
| CPSC | Consumer Product Safety Commission |
| DOC | Department of Commerce |
| DOD | Department of Defense |
| DOE | Department of Energy |
| EPA | Environmental Protection Agency |
| FAA | Federal Aviation Administration |
| FCC | Federal Communications Commission |
| FDA | Food and Drug Administration |
| GSA | General Services Administration |

REFERENCES

| | |
|-------|--|
| HUD | Department of Housing and Urban Development |
| LBL | Lawrence Berkeley National Laboratory |
| NCHRP | National Cooperative Highway Research Program (See TRB) |
| NIST | National Institute of Standards and Technology |
| OSHA | Occupational Safety & Health Administration |
| PBS | Public Buildings Service (See GSA) |
| PHS | Office of Public Health and Science |
| RUS | Rural Utilities Service (See USDA) |
| SD | State Department |
| TRB | Transportation Research Board |
| USDA | Department of Agriculture |
| USPS | Postal Service |

- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up to date as of the date of the Contract Documents.

| | |
|---------|--|
| ADAAG | Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board |
| CFR | Code of Federal Regulations Available from Government Printing Office |
| DOD | Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point |
| DSCC | Defense Supply Center Columbus (See FS) |
| FED-STD | Federal Standard (See FS) |
| FS | Federal Specification |

REFERENCES

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Available from Department of Defense Single Stock Point

Available from Defense Standardization Program

Available from General Services Administration

Available from National Institute of Building Sciences

FTMS Federal Test Method Standard
(See FS)

MIL (See MILSPEC)

MIL-STD (See MILSPEC)

MILSPEC Military Specification and Standards
Available from Department of Defense Single Stock Point

UFAS Uniform Federal Accessibility Standards
Available from Access Board

- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up to date as of the date of the Contract Documents.

CBHF State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation

CCR California Code of Regulations

CPUC California Public Utilities Commission

TFS Texas Forest Service
Forest Resource Development

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

REFERENCES

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

- A. General: Installation and removal of temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Bucks County Free Library's existing water system is available for use without metering and without payment of use charges.
- C. Electric Power Service from Existing System: Electric power from Bucks County Free Library's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.4 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Coordinate the use of existing facilities with County. All existing systems required for temporary use shall be returned to preconstruction conditions.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

- A. Field Office and Material Storage: Location shall be approved by Bucks County Free Library prior to commencement of work.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Existing HVAC system shall be used.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service overhead unless otherwise indicated.
 - 2. Connect temporary service to Library's existing power source, as directed by Library.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Bucks County Free Library.
- B. Waste Disposal Facilities: Contractor shall be responsible for removal of trash from site daily.

TEMPORARY FACILITIES AND CONTROLS

- C. Waste Disposal Facilities: Coordinate waste removal with Library. Waste shall not be allowed to accumulate in any areas. Waste shall be removed from the site daily.
- D. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided the stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- C. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- D. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Library and from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Construct dustproof partitions with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover the floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
 - 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 4. Insulate partitions to control noise transmission to occupied areas.
 - 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 6. Protect air-handling equipment.
 - 7. Provide walk-off mats at each entrance through temporary partition.
- E. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
 - 1. Prohibit smoking in construction areas.

TEMPORARY FACILITIES AND CONTROLS

015000-3

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when the need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Bucks County Free library reserves the right to take possession of Project identification signs.
 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period.

END OF SECTION 015000

SECTION 016350 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3 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 CSI Form 13.1A (Refer to Appendix for sample form).
 - 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 Bucks County Free Library 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.

SUBSTITUTION PROCEDURES

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- g. List of similar installations for completed projects with project names and addresses and names and addresses of Architects and Libraries.
 - 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.
 - 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 seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven 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.

1.4 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.

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 15 days prior to time required for preparation and review of related submittals.

SUBSTITUTION PROCEDURES

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1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution will not adversely affect Contractor's construction schedule.
 - c. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - d. Requested substitution is compatible with other portions of the Work.
 - e. Requested substitution has been coordinated with other portions of the Work.
 - f. Requested substitution provides specified warranty.
 - g. 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.

END OF SECTION 016350

SECTION 017000 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of County-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.
- B. Related Requirements:
 - 1. Division 1 Section "Summary" for limits on use of Project site.

1.2 INFORMATIONAL SUBMITTALS

- A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.3 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. 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.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying

capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and County that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

EXECUTION REQUIREMENTS

- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 1 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
 - 1. Do not scale Drawings to obtain required dimensions.
 - 2. Inform installers of lines and levels to which they must comply.
 - 3. Check the location, level and plumb, of every major element as the Work progresses.
 - 4. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

EXECUTION REQUIREMENTS

- F. Tools and Equipment: Do not use tools or equipment that produce noise levels disruptive to occupants in adjacent spaces.
- G. Templates: Obtain and distribute to the parties' involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

EXECUTION REQUIREMENTS

- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering, and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 5. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials for more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

EXECUTION REQUIREMENTS

3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safety. Replace damaged and malfunctioning controls and equipment.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017000

SECTION 017320 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of a building or structure.
2. Salvage of existing items to be reused or recycled.

1.2 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:** Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall:** Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain:** Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed, and salvaged, or removed and reinstalled.

1.3 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference:** Conduct conference at Project site prior to commencement of demolition.

1.4 FIELD CONDITIONS

- A.** The owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B.** Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C.** Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials:** Hazardous materials are present in buildings and structures to be selectively demolished.

1. Hazardous material remediation is the responsibility of the Contractor.
 2. Existing conditions in areas of new work, or work disturbed due to demolition, shall be tested by the Contractor, and proper remediation provided.
 3. All hazardous materials removal shall be coordinated with Owner's Representative.
 4. All hazardous material remediation in occupied areas of the building shall occur on the Weekends.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

1.5 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. 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 Engineer.

SELECTIVE DEMOLITION

- D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings or preconstruction photographs.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to County.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

- A. 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. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. 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.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. 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.
 - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 5. Dispose of demolished items and materials promptly.
- B. Removed and Salvaged Items:
 - 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 County's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.

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3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by 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.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 017320

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Division 1 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Division 1 Section "Demonstration and Training" for requirements for instructing County's personnel.

1.2 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Bucks County Free Library unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 1 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit test/adjust/balance records.
 - 4. Submit changeover information related to Library's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Bucks County Free Library of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Bucks County Free Library. Advise Library's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Bucks County Free Library's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 1 Section "Demonstration and Training."
 - 6. Advise Bucks County Free Library of changeover in heat and other utilities.
 - 7. Participate with Bucks County Free Library in conducting inspection and walkthrough with local emergency responders.
 - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 9. Complete final cleaning requirements, including touchup painting.
 - 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, the 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

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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.

1.6 FINAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Bucks County Free Library's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.

B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, the Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. The architect will prepare a final Certificate for Payment after inspection or will notify the 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.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Submit list of incomplete items in the following format:
 - a. Three paper copies unless otherwise indicated. Architect will return two copies.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Bucks County Free Library's rights under warranty.
- B. 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, three-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 the Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in the operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

CLOSEOUT PROCEDURES

- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, 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. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Division 1 Section "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017810 – 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. Division 1 Section "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 copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit three paper-copy set(s) of marked-up record prints.
 - 2) Submit record digital data files and two set(s) of plots.
 - 3) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit three paper-copy set(s) of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and three set(s) of prints.
 - 3) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit three paper copies, and one annotated PDF electronic file, of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit three paper copies, and one annotated PDF electronic file, 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 Engineer. 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: DWG, Version , Microsoft Windows or Apple Macintosh operating system.
 - 3. Format: Annotated PDF electronic file with comment function enabled.
 - 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - 5. Refer instances of uncertainty to Engineer for resolution.
 - 6. Engineer 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:

PROJECT RECORD DOCUMENTS

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- a. Project name.
- b. Date.
- c. Designation "PROJECT RECORD DRAWINGS."
- d. Name of Engineer.
- 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 annotated PDF electronic, file paper copy and 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 annotated PDF electronic file, paper copy and 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 PDF electronic file, paper copy and 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 Engineer's reference during normal working hours.

END OF SECTION 017810

SECTION 017820 - 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. The 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.
- 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 will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

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.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. 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.

OPERATION AND MAINTENANCE DATA

- C. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017820

SECTION 024119 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Selective Building Demolition:

1. Selective demolition of interior partitions, systems, and building components designated to be removed.
2. Selective demolition of exterior facade, structures, and components designated to be removed.
3. Removal of abandoned utilities and wiring systems.
4. Notification to Owner of schedule of shut-off of utilities which serve occupied spaces.
5. Pollution control during selective demolition, including noise control.
6. Removal and legal disposal of materials.
7. Protection of adjacent construction.
8. Interruption, capping or removal of utilities as applicable.

1.2 SUBMITTALS

- ##### A. Schedule:
- Submit for approval selective demolition schedule, including schedule and methods for capping utilities to be abandoned and maintaining existing utility service.

1.3 QUALITY ASSURANCE

- ##### A. Codes and Regulations:
- Comply with governing codes and regulations. Use experienced workers.

1.4 PRE-INSTALLATION MEETINGS

- ##### A. Convene minimum two weeks prior to starting work of this section.

1.5 SEQUENCING

- ##### A. Immediate areas of work will not be occupied during selective demolition. The public, including children, may occupy adjacent areas.
- ##### B. No responsibility for buildings and structures to be demolished will be assumed by the Owner.
- ##### C. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

PART 2 - PRODUCTS - Not applicable to this Section.

PART 3 - EXECUTION

3.1 SELECTIVE DEMOLITION

- ##### A. Demolition Operations:
- Do not damage building elements and improvements indicated to remain. Items of salvage value, not included on schedule of salvage items to be returned to

SELECTIVE DEMOTION

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Owner, shall be removed from structure. Storage or sale of items at project site is prohibited.

- B. Utilities: Locate, identify, disconnect, and seal or cap off utilities in buildings to be demolished.
- C. Shoring and Bracing: Provide and maintain interior and exterior shoring and bracing.
- D. Occupied Spaces: Do not close or obstruct streets, walks, drives or other occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction. Do not interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.
- E. Security: Provide adequate protection against accidental trespassing. Secure project after work hours.
- F. Restoration: Restore finishes of patched areas.

3.2 SCHEDULE

- A. Items to be Salvaged for Reinstallation
 - 1. [Light Fixtures.]
- B. Items to be Salvaged for Delivery to Owner:
 - 1. [Doors and hardware.]
 - 2. [Toilet accessories.]
 - 3. [Light fixtures.]
 - 4. [Lockers.]
- C. Utilities Requiring Interruption, Capping, or Removal as Required
 - 1. [Electric.]
 - 2. [Heat.]
 - 3. [Water.]
 - 4. [Gas.]

END OF SECTION 024119

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

1.2 SUBMITTALS:

- A. Manufacturer's literature and data:
 - 1. Submit data for lumber, panels, hardware and adhesives.
 - 2. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
- B. Manufacturer's certificate for unmarked lumber.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.4 QUALITY ASSURANCE:

- A. Installer: a firm with a minimum of three (3) years' experience in the type of work required by this section.

1.5 GRADING AND MARKINGS:

- A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on the construction site. For lumber and material not normally grade marked, provide manufacturer's certificates (approved by an american lumber standards approved

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agency) attesting that lumber and material meet the specified the specified requirements.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):
 - 1. Nds-15 National Design Specification for Wood Construction
 - 2. Wcd1-01 Details for Conventional Wood Frame Construction
- C. American Society of Mechanical Engineers (ASME):
 - 1. B18.2.1-12(r2013) Square and Hex Bolts and Screws
 - 2. B18.2.2-10 Square and Hex Nuts
 - 3. B18.6.1-81(r2008) Wood Screws
- D. American Plywood Association (APA):
 - 1. E30-11 Engineered Wood Construction Guide
- E. American Wood Protection Association (AWPA):
 - 1. AWPA Book Of Standards
- F. Forest Stewardship Council (FSC):
 - 1. FSC-STD-01-001(ver. 4-0)fsc principles and criteria for forest stewardship
- G. Environmental Protection agency (epa):
 - 1. 40 CFR 59(2014) National Volatile Organic Compound Emission Standards For Consumer And Commercial Products
- H. U.S. Department of Commerce Product Standard (PS)
 - 1. PS 1-95 Construction And Industrial Plywood

PART 2 - PRODUCTS

ROUGH CARPENTRY

2.1 PLYWOOD:

- A. Comply with PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:
 - 1. APA rated exposure exterior; panel grade CD or better.
 - 2. Roof sheathing:
 - a. Minimum 11/32 inch thick with span rating 24/0 or 15/32 inch thick with span rating for supports 16 inches on center unless specified otherwise.
 - b. Minimum 19/32 inch thick or span rating of 40/20 or 23/32 inch thick or span rating of 48/24 for supports 24 inches on center.

2.2 STRUCTURAL-USE PANELS:

- A. Comply with APA E30-11.
- B. Bearing the mark of a recognized association or independent agency that maintains continuing control over quality of panel which identifies compliance by end use, span rating, and exposure durability classification.
- C. Wall and roof sheathing:
 - 1. APA Rated sheathing panels, durability classification of exposure 1 or exterior span rating of 16/0 or greater for supports 16 inches on center and 24/0 or greater for supports 24 inches on center.

2.3 ROUGH HARDWARE AND ADHESIVES:

- A. Screws:
 - 1. Wood to wood: ASME B18.6.1 or ASTM C1002.
 - 2. Wood to steel: ASTM C954, or ASTM C1002.
- B. Nails:
 - 1. Size and type best suited for purpose unless noted otherwise. Provide aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.

2. ASTM F1667:

- a. Common: Type I, style 10.
- b. Concrete: Type I, style 11.
- c. Barbed: Type I, style 26.
- d. Underlayment: Type I, style 25.
- e. Masonry: Type I, style 27.
- f. Provide special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

C. Adhesives:

1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
2. For structural laminated wood: ASTM D2559.
3. Adhesives to have a VOC content of 70 g/l or less when calculated according to 40 CFR 59, (EPA method 24).

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:

1. AFPA NDS for timber connectors.
2. AITC A190.1 timber construction manual for heavy timber construction.
3. AFPA WCD1 for nailing and framing unless specified otherwise.
4. APA for installation of plywood or structural use panels.

END OF SECTION 061000

SECTION 064000 – ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Medium density fiberboard panels with no added formaldehyde resins (NAF).

1.2 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged pallets with identification labels intact.
- B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions in strict compliance with manufacturer's instructions and industry standards.
 - 1. If unloaded outdoors, move and store under shelter as soon as possible. Avoid unloading in inclement weather.
 - 2. Inspect delivered products to verify products are not damaged, soiled or have been exposed to water.
- C. Handling: Protect materials during handling and installation to prevent damage.

1.3 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.4 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard limited warranty against defects in manufacturing.

PART 2 PRODUCTS

2.1 MEDIUM DENSITY FIBERBOARD PANELS

- A. Interior Medium Density Fiberboard Panels made with NAF Resin:
 - 1. Basis of Design: Manufacturer selected by contractor with approval of Architect and Owner
- B. Laminate Clad Countertops:
 - 1. Construct laminate countertop substrate of 19 mm (3/4 inch).
 - a. Medium density fiberboard (MDF).
 - 2. Moisture-resistant where countertops receive sinks, lavatories, or are subjected to liquids.
 - 3. Sink cutout edges sealed with appropriate sealant against moisture.
 - 4. No joints to occur at cutouts.
 - 5. Balanced backer sheet.

C. Fasteners:

1. Panel Z-Clips: As furnished by panel fabricator.
2. Plated Fasteners: Wood screws, finish nails, bolts, and nuts.

D. General Requirements:

1. Type: Medium density fiberboard panels with no added formaldehyde.
2. Composition: Lignocellulosic fibers and no-added formaldehyde synthetic resin.
3. Thickness: 1/4 to 1-1/2 in (6 to 38 mm), as indicated on Drawings.
4. Faced-paneling: Hardwood, faced on both surfaces.
5. Faced-paneling: Low-pressure laminate, faced on both surfaces.
6. Faced-paneling: High-pressure laminate faced on both surfaces.

E. Fabrication Requirements:

1. Architectural Woodwork Quality Standards (AWI): Comply with sections 100, 200, 300, 400, 500, 700, 1500, and 1700.
2. Casework Panel Construction:
 - a. Panel and Trim Thickness:
 - 1) Standard Panels: Top, bottom, side, and interior panels: 3/4 in (19 mm) thick.
 - 2) Cabinet Base: 3/4 in (19 mm) thick moisture resistant panels.
 - 3) Shelves up to 30 in (762 mm) wide: 3/4 in (19 mm) thick.
 - 4) Upper Cabinet Backs: 1/2 in (13 mm) thick.
 - 5) Lower Cabinet Backs: 1/4 in (6 mm) thick.
 - 6) Cabinet Doors: 3/4 in (19 mm) thick.
 - 7) Drawer Fronts: 3/4 in (19 mm) thick.
 - 8) Drawer Sides: 1/2 in (13 mm) thick. (Fabricator may face top edges with PVC.)
 - 9) Drawer Sub-Front and Back Panels: 3/4 in (19 mm) thick.
 - 10) Drawer Bottoms: 1/4 in (6 mm) thick. (Fabricator may use 1/4 in (6 mm) thick tempered hardboard and set into sides and sub-front of drawers with continuous groove.)
 - 11) Drawer Cabinet Dividers between each Drawer: 3/4 in (19 mm) thick.
 - 12) Countertop Panels at Countertop Front Edge: 1-1/2 in (38 mm) thick, fabricated in two layers of no-added formaldehyde medium density fiberboard panels.
 - a) Moisture-resistant panels are required for countertops with sinks.
 - b. Laminate Finish:
 - 1) Low-Pressure on Exposed Panel Surfaces: ANSI Z124.3, type 5 or type 6, polyester or melamine laminate in color, pattern, and surface texture as selected by Architect from manufacturer's standard colors, patterns, and surface textures.

PART 3 EXECUTION

3.1 EXAMINATION

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- A. Examine substrates and conditions to ensure that work can be completed with no adverse effects.

PREPARATION

- A. Prepare substrates using methods recommended by the manufacturer to achieve the best results for the panels under proper conditions.
- B. Do not proceed with installation until substrates have been fabricated based on recommended methods from the manufacturer. Commencement of installation constitutes acceptance of conditions of substrate.

3.2 INSTALLATION

- A. Comply with AWI AWS fabrication and installation standard as applicable to the project.
- B. Install fabricated TFL panels according to approved architectural drawings, shop drawings and manufacturer's published installation instructions, Shim as required for proper installation.

3.3 CLEANING AND PROTECTION

- A. Clean panels in accordance to manufacturer's published care and maintenance instructions.
- B. Touch up, repair or replace damaged products before completing installation.

END OF SECTION 064000

SECTION 092216 – NON-LOAD-BEARING STEEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Non-Structural Cold Formed Metal Drywall Studs and Track.
- B. Area Separation

1.2 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging with identification labels intact until ready for installation.
- B. Keep products dry by storing them inside under a roof. If necessary to store material outdoors, it must be stacked on pallets off the ground on a level base and fully protected from the weather.

1.3 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 DRYWALL STUDS AND TRACK

- A. General Requirements:
 - 1. Physical properties and load tables have been calculated in conformance with the 2001 NASPEC for the Design of Cold-Formed Steel Structural Members, unless noted otherwise.
 - 2. Drywall framing members have a protective coating conforming to ASTM spec A 653/A 653M, G-40 min, or equivalent corrosion resistance.
 - 3. Reference ASTM specification A 1003/A 1003 M table 1 for the universe of allowable coatings for light gauge steel framing.
 - 4. Drywall framing members are marked with product information per the requirements of ASTM C 645 section 14.

2.2 MATERIALS

- A. Cold-Formed Steel Sheet: Complying with ASTM A 1003/A 1003M, unless indicated otherwise.
- B. Galvanized Coating: CP40 or equivalent coating weight minimum, complying with ASTM C 645.

2.3 FABRICATION

NON-LOAD-BEARING STEEL FRAMING

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- A. General: Framing components may be pre-assembled into panels prior to erecting.
- B. Fabricate panels square, with components attached in a manner so as to prevent racking or distortion.
- C. Cut all framing components squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Hold members positively in place until properly fastened.
- D. Provide insulation as specified elsewhere in all double jamb studs and double header members, which will not be accessible to the insulation contractor.
- E. Fasteners: Fasten components using self-tapping screws or welding.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of metal framing in accordance with manufacturer's installation instructions.
- B. Verify that rough-in utilities and chases are in correct locations and do not interfere with framing placement.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. General Erection Requirements:
 - 1. Install cold-formed framing in accordance with requirements of ASTM C 754.
- B. Wall Framing:
 - 1. Erect framing and panels plumb, level and square in strict accordance with the Drawings and the approved shop drawings.
 - 2. Handle and lift prefabricated panels in a manner so as not to cause distortion in any member.
 - 3. Anchor runner track securely to the supporting structure. Install concrete anchors only after full compressive strength has been achieved.
 - 4. Provide a sill sealer or gasket barrier between all concrete and steel connections.
 - 5. Butt all track joints. Securely anchor abutting pieces of track to a common structural element or butt-weld or splice them together.
 - 6. Align and plumb studs, and securely attach to the flanges or webs of both upper and lower tracks except when vertical movement is specified.

NON-LOAD-BEARING STEEL FRAMING

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7. Frame wall openings to include headers and supporting studs as shown in the Drawings.
8. Coordinate erection of studs with requirements of door frames, window frames, and other similar openings.
9. Install jack studs or cripples below windowsills, above window and door heads, at freestanding stair rails and elsewhere to furnish support, securely attached to supporting members.
10. Attach wall stud bridging in a manner to prevent stud rotation. Space bridging rows according to manufacturer's recommendations.
11. Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.
12. Provide temporary bracing until erection is completed.
13. Maintain clearance under structural building members to avoid deflection transfer to studs. Install extended leg ceiling runners.
14. Coordinate placement of insulation in stud spaces after stud frame erection.

3.4 ERECTION TOLERANCES

- A. Section 01 40 00 - Quality Requirements.
- B. Maximum Variation from Indicated Position: 1/8 inch in 10 feet (3 mm in 3 m).
- C. Maximum Variation from Plumb: 1/8 inch in 10 feet (3 mm in 3 m).

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 092216

SECTION 095123 – ACOUSTICAL TILE CEILING

PART 1 GENERAL

1. SUMMARY

- a. Section includes acoustical panels and exposed suspension systems for interior ceilings.

2. PREINSTALLATION MEETINGS

- a. Preinstallation Conference: Conduct conference at Project site.

3. ACTION SUBMITTALS

- a. Product Data: For each type of product.
- b. Samples: For each exposed product and for each color and texture specified.

4. INFORMATIONAL SUBMITTALS

- a. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.
- b. Product test reports.
- c. Research reports.
- d. Field quality-control reports.

5. CLOSEOUT SUBMITTALS

- a. Maintenance data.

6. MAINTENANCE MATERIAL SUBMITTALS

- a. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1) Acoustical Ceiling Units: Full-size panels equal to 10 percent of quantity installed.
 - 2) Suspension-System Components: Quantity of each exposed component equal to 10 percent of quantity installed.
 - 3) Hold-Down Clips: Equal to 10 percent of quantity installed.
 - 4) Impact Clips: Equal to 10 percent of quantity installed.

ACOUSTICAL TILE CEILINGS

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PART 2 PRODUCTS

1. PERFORMANCE REQUIREMENTS

- a. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.
- b. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- c. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.
 - 1) Flame-Spread Index: Class A according to ASTM E 1264.
 - 2) Smoke-Developed Index: 50 or less.

2. ACOUSTICAL PANELS

- a. Manufacturers and Products: Refer to Finish Legend on Drawings.
- b. Acoustical Panel Standard: Manufacturer's standard panels according to ASTM E 1264.

3. METAL SUSPENSION SYSTEM

- a. Refer to Finish Schedule on Drawings for manufacturers and products.
- b. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M.

4. ACCESSORIES

- a. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- b. Hold-Down Clips: Manufacturer's standard hold-down.
- c. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- d. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

ACOUSTICAL TILE CEILINGS

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5. METAL EDGE MOLDINGS AND TRIM

- a. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

PART 3 EXECUTION

1. PREPARATION

- a. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.
- b. Layout openings for penetrations centered on the penetrating items.

2. INSTALLATION

- a. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.
- b. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1) Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2) Do not use exposed fasteners, including pop rivets, on moldings and trim.
 - 3) Arrange directionally patterned acoustical panels as follows:
 - a) As indicated on reflected ceiling plans.
 - 4) Install hold-down and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

3. FIELD QUALITY CONTROL

- a. Special Inspections: Engage a qualified special inspector to perform inspections.
 - 1) Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

END OF SECTION 095123

ACOUSTICAL TILE CEILINGS

095123-3

SECTION 096516 – RESILIENT SHEET FLOORING

PART 1 GENERAL

1. SUMMARY

- a. Section includes vinyl sheet flooring.

2. ACTION SUBMITTALS

- a. Product Data: For each type of product.
- b. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1) Show details of special patterns.
- c. Samples: For each exposed product and for each color and texture specified in manufacturer's standard size, but not less than 6-by-9-inch sections.
 - 1) For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

3. CLOSEOUT SUBMITTALS

- a. Maintenance data.

4. MAINTENANCE MATERIAL SUBMITTALS

- a. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1) Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

PART 2 PRODUCTS

1. PERFORMANCE REQUIREMENTS

- a. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1) Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

RESILIENT SHEET FLOORING

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2. VINYL SHEET FLOORING

- a. Manufacturers and Products: Refer to Finish Legend on Drawings.

3. INSTALLATION MATERIALS

- a. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.
- b. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
- c. Seamless-Installation Accessories:
 - 1) Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a) Color: Match flooring.
 - 2) Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
- d. Integral-Flash-Cove-Base Accessories:
 - 1) Cove Strip: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
 - 2) Cap Strip: As recommended by resilient sheet flooring manufacturer.
 - 3) Corners: As recommended by resilient sheet flooring manufacturer.
- e. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 EXECUTION

1. PREPARATION

- a. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.
- b. Concrete Substrates: Prepare according to ASTM F 710.
 - 1) Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2) Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
 - 3) Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
 - 4) Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than the following:

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- a) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- c. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- d. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.
- e. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

2. RESILIENT SHEET FLOORING INSTALLATION

- a. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- b. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- c. Lay out resilient sheet flooring as follows:
 - 1) Maintain uniformity of flooring direction.
 - 2) Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
 - 3) Match edges of flooring for color shading at seams.
 - 4) Avoid cross seams.
- d. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
- e. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- f. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- g. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- h. Seamless Installation:
 - 1) Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
 - 2) Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless flooring. Prepare seams and apply compound to produce

tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.

- i. Integral-Flash-Cove Base: Cove resilient sheet flooring to dimension indicated up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

3. CLEANING AND PROTECTION

- a. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.
- b. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.
 - 1) Apply two coats.
- c. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096519 – RESILIENT TILE FLOORING

PART 1 GENERAL

1. SUMMARY

- a. Section Includes:
 - 1) Vinyl composition floor tile.

2. ACTION SUBMITTALS

- a. Product Data: For each type of product.
- b. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1) Show details of special patterns.
- c. Samples: Full-size units of each color and pattern of floor tile required.

3. CLOSEOUT SUBMITTALS

- a. Maintenance data.

4. MAINTENANCE MATERIAL SUBMITTALS

- a. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1) Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 PRODUCTS

1. PERFORMANCE REQUIREMENTS

- a. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1) Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2. VINYL COMPOSITION FLOOR TILE

- a. Manufacturers and Products: Refer to Finish Legend on Drawings.
- b. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.
- c. Wearing Surface: Smooth.
- d. Thickness: 0.125 inch.
- e. Size: 12 by 12 inches.
- f. Colors and Patterns: Refer to Finish Legend on Drawings.

3. INSTALLATION MATERIALS

- a. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- b. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- c. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 EXECUTION

1. PREPARATION

- a. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- b. Concrete Substrates: Prepare according to ASTM F 710.
 - 1) Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2) Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3) Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
 - 4) Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a) Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

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- b) Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- c. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- d. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
- e. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

2. FLOOR TILE INSTALLATION

- a. Comply with manufacturer's written instructions for installing floor tile.
- b. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1) Lay tiles in pattern indicated.
- c. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1) Lay tiles in pattern of colors and sizes indicated.
- d. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- e. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- f. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- g. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3. CLEANING AND PROTECTION

- a. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- b. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish in accordance with resilient tile flooring manufacturer's recommendations.

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- c. Cover floor tile until Substantial Completion.

END OF SECTION 096519

RESILIENT TILE FLOORING

096519-4

Bucks County Free Library Renovation Yardley Branch

SECTION 096813 – TILE CARPETING

PART 1 GENERAL

1. SUMMARY

a. Section includes:

- 1) Modular carpet tile.

2. ACTION SUBMITTALS

a. Product Data: For each type of product.

b. Shop Drawings: For carpet tile installation, plans showing the following:

- 1) Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
- 2) Carpet tile type, color, and dye lot.
- 3) Type of subfloor.
- 4) Type of installation.
- 5) Pattern of installation.
- 6) Pattern type, location, and direction.
- 7) Pile direction.
- 8) Type, color, and location of insets and borders.
- 9) Type, color, and location of edge, transition, and other accessory strips.
- 10) Transition details to other flooring materials.

c. Samples: For each exposed product and for each color and texture required.

3. INFORMATIONAL SUBMITTALS

a. Product test reports.

b. Sample warranty.

4. CLOSEOUT SUBMITTALS

a. Maintenance data.

5. MAINTENANCE MATERIAL SUBMITTALS

a. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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- 1) Carpet Tile: Full-size units equal to 10 percent of amount installed for each type indicated, but not less than 10 sq. yd.

6. QUALITY ASSURANCE

- a. Installer Qualifications: Certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

7. WARRANTY

- a. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1) Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

1. CARPET TILE

- a. Manufacturers and Products: Refer to Finish Legend on Drawings.
- b. Applied Treatments:
 - 1) Soil-Resistance Treatment: Manufacturer's standard treatment.
 - 2) Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
 - a) Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

2. INSTALLATION ACCESSORIES

- a. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- b. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 EXECUTION

1. EXAMINATION

- a. Concrete Slabs:

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- 1) Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a) Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours.
 - b) Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c) Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

2. PREPARATION

- a. General: Comply with CRI's "CRI Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- b. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- c. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- d. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3. INSTALLATION

- a. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- b. Installation Method: As recommended in writing by carpet tile manufacturer.
- c. Maintain dye-lot integrity. Do not mix dye lots in same area.
- d. Maintain pile-direction patterns indicated on Drawings.
- e. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- f. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

- g. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, non-staining marking device.
- h. Install pattern parallel to walls and borders.
- i. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099000 – INTERIOR, EXTERIOR, AND HIGH-PERFORMANCE PAINTS AND COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior paint and coating commercial systems including surface preparation.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, Architect will select from standard products, colors and sheens available.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless indicated.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information.
 - 1. Product name, and type (description).
 - 2. Application and use instructions.
 - 3. Surface preparation.
 - 4. VOC content.
 - 5. Environmental handling.
 - 6. Batch date.
 - 7. Color number.
- B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.
- D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.4 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.5 EXTRA MATERIALS

INTERIOR, EXTERIOR, AND HIGH-PERFORMANCE PAINTS AND COATINGS

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- A. Furnish extra paint materials from the same production run as the materials applied and, in the quantities, described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
- B. Furnish Owner with an additional one percent of each material and color, but not less than 1 gal (3.8 l) or 1 case, as appropriate.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Sherwin-Williams, which is located at: 101 Prospect Ave.; Cleveland, OH 44115; ASD Toll Free Tel: 800-524-5979; Tel: 216-566-2000; Fax: 440-826-1989; Email: request info specifications@sherwin.com; Web: www.swspecs.com.

2.2 APPLICATIONS/SCOPE

- A. Interior Paint and Coating Commercial Systems:
 - 1. Concrete: Poured, precast, tilt-up, cast-in-place, cement board, plaster.
 - 2. Concrete: Non-vehicular floors.
 - 3. Masonry: Concrete masonry units, including split-face, scored, and smooth block.
 - 4. Metal: Aluminum, galvanized steel.
 - 5. Metal: Structural steel, joists, trusses, beams, partitions and similar items.
 - 6. Wood: Walls, ceilings, doors, trim and similar items.
 - 7. Drywall: Drywall board, Gypsum board.

2.3 PAINT MATERIALS - GENERAL

- A. Paints and Coatings:
 - 1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
 - 2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color. Or follow manufactures product instructions for optimal color conformance.
- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.
- D. Color: Refer to Finish Schedule for paint colors, and as selected.

2.4 INTERIOR PAINT AND COATING COMMERCIAL SYSTEMS

- A. Metal: Aluminum and Galvanized.
 - 1. Latex Systems:
 - a. Gloss Finish High Performance:
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).

INTERIOR, EXTERIOR, AND HIGH-PERFORMANCE PAINTS AND COATINGS

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- 2) 2nd Coat: S-W Pro Industrial Acrylic Gloss, B66-600 Series.
 - 3) 3rd Coat: S-W Pro Industrial Acrylic Gloss, B66-600 Series (2.0-4.0 mils dry per coat).
 - b. Semi-Gloss Finish High Performance:
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
 - 2) 2nd Coat: S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series.
 - 3) 3rd Coat: S-W Pro Industrial Acrylic Semi-Gloss, B66-650 Series (2.0-4.0 mils dry per coat).
 - c. Egg-Shel / Satin Finish High Performance:
 - 1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
 - 2) 2nd Coat: S-W Pro Industrial Acrylic Egg-Shell, B66-660 Series.
 - 3) 3rd Coat: S-W Pro Industrial Acrylic Egg-Shell, B66-660 Series (2.0-4.0 mils dry per coat).
- B. Drywall: Walls, Ceilings, Gypsum Board and similar items.
- 1. Latex Systems:
 - a. Semi-Gloss Finish:
 - 1) 1st Coat: S-W ProMar200 Zero VOC Interior Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry).
 - 2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series.
 - 3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series (4 mils wet, 1.5 mils dry per coat).
 - b. Egg-Shel / Satin Finish:
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry).
 - 2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Egg-Shel, B20-2600 Series.
 - 3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Egg-Shel, B20-2600 Series (4 mils wet, 1.7 mils dry per coat).
 - c. Low Sheen Finish:
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry).
 - 2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Low Gloss Eggshell, B41-2600 Series.
 - 3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Low Gloss Eggshell, B41-2600 Series (4 mils wet, 1.6 mils dry per coat).
 - d. Flat Finish:
 - 1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry).
 - 2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series.
 - 3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Flat, B30-12600 Series (4 mils wet, 1.6 mils dry per coat).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared; notify Architect of INTERIOR, EXTERIOR, AND HIGH-PERFORMANCE PAINTS AND COATINGS

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unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

- B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.
- C. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead-based paints, notify Architect immediately if lead based paints are encountered.

3.2 SURFACE PREPARATION

- A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.
 - 1. Prior to attempting to remove mildew, it is recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions are advised.
 - 2. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply solution and scrub the mildewed area. Allow solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow surface to dry before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.
 - 3. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
 - 4. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50 degrees F (10 degrees C), unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface and material temperatures must be 50 degrees F (10 degrees F) or higher to use low temperature products.
- B. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
- C. Drywall - Interior: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.

3.3 INSTALLATION

- A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.
- B. Do not apply to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content. Wait until wood is fully dry after rain or morning fog or dew.

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- C. Apply coatings using methods recommended by manufacturer.
- D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.
- E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.
- F. Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.
- G. Inspection: The coated surface must be inspected and approved by the Architect just prior to the application of each coat.

3.4 PROTECTION

- A. Protect finished coatings from damage until completion of project.
- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF DOCUMENT 099000

SECTION 102813 – TOILET ACCESSORIES

PART 1 GENERAL

1. SUMMARY

- a. Section Includes:
 - 1) Public-use washroom accessories.

2. ACTION SUBMITTALS

- a. Product Data: For each type of product.
- b. Samples: Full size, for each exposed product and for each finish specified.

3. INFORMATIONAL SUBMITTALS

- a. Sample warranty.

4. CLOSEOUT SUBMITTALS

- a. Maintenance data.

5. WARRANTY

- a. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1) Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

1. PERFORMANCE REQUIREMENTS

- a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. PUBLIC-USE WASHROOM ACCESSORIES

- a. Manufacturers and Products: Refer to Plumbing and Accessory Schedule on Drawings.

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3. FABRICATION

- a. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of two keys to Owner's representative.

PART 3 EXECUTION

1. INSTALLATION

- a. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- b. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

END OF SECTION 102813

SECTION 220501 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

- 1.1 Applicable requirements of the Contract Documents, preceding the technical Specifications, apply to this Section. In the event of conflict between the Specifications, the most stringent shall apply.
- 1.2 Separations of these Specifications into divisions and sections is for convenience only and is not intended to establish limits of work.
- 1.3 Consult index to be certain that set of documents and Specifications is complete. Report omissions or discrepancies to the Owner's Representative.
- 1.4 The Contractor shall employ high standards of good workmanship and shall pay special attention to the safety of the equipment. The installation of material and equipment shall be in conformance with the codes and standards listed in Paragraph: STANDARDS. The agency having the most stringent requirements shall be adhered to.
- 1.5 The Contractor shall make a thorough examination of the site and shall make due allowances for difficulties and contingencies to be encountered. All dimensions shall be checked and verified by the Contractor at the site.
- 1.6 The Contractor and all Sub-Contractors shall have a minimum of three years proven experience on projects with similar levels of complexity and magnitude. Experience shall be based on the experience as a company and not on the experience as individuals.
- 1.7 The Drawings and Specifications are intended to function as a common set of documents. Anything shown on the Drawings but not mentioned in the Specifications or mentioned in the Specifications and not shown on the Drawings, shall be equally binding as if both noted on the Drawings and called for in the Specifications.
- 1.8 SCOPE.
 - A. The work covered by and included in these Specifications consists of the furnishing of all materials, all equipment, labor, tools and supervision and performing all operations necessary for the proper and complete execution of the Plumbing work in strict accordance with the Specifications and the Drawings and subject to the terms and conditions of the Contract.

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1.9 DEFINITIONS.

- A. The term "Contractor" or "Plumbing Contractor" when used in this Specification refers to the Contractor responsible for all work under this Section.
- B. The term "Provide" refers to this Contractor purchasing, delivering and installing as a part of this Contract.
- C. The term "ATC" refers to Automatic Temperature Controls.

1.10 STANDARDS.

- A. Meet requirements and recommendations of applicable portions of the latest edition of all codes and standards, as adopted by the local authority having jurisdiction, including those listed.
 - 1. American National Standards Institute Standards (ANSI).
 - 2. American Society of Mechanical Engineers (ASME).
 - 3. American Society for Testing and Materials Standards (ASTM).
 - 4. American Welding Society Standards (AWS).
 - 5. American Water Works Association (AWWA).
 - 6. 2015 Uniform Construction Code (PA-UCC).
 - 7. 2018 International Building Code (ICC).
 - 8. 2018 International Energy Conservation Code (IECC).
 - 9. 2018 International Plumbing Code (IPC).
 - 10. National Fire Protection Association Standards (NFPA).
 - 11. Occupational Safety and Health Administration (OSHA).
 - 12. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - 13. Underwriter's Laboratories Publication (UL).
 - 14. Regulations of the Pennsylvania State Police, Fire Marshall Division.
 - 15. Pennsylvania Department of Labor and Industry, Fire and Panic Regulations.
 - 16. Public Law 101-336, The Americans with Disabilities Act of 1990.
- B. Should any change in the Drawings and/or Specifications be required to conform to the codes, ordinances, regulations or laws mentioned above, the Owner's Representative shall be notified prior to the time of submitting bids.

1.11 NOTIFICATION.

- A. Trades that have work connected with the Plumbing work and trades that do preparatory work for Plumbing shall be notified for installation requirements and scheduling.
- B. The Owner's Representative shall be informed of the installation schedule to allow sufficient time for inspection without any work delay.
- C. All work shall be coordinated to avoid cutting of work in place and interfering with other operations.

- D. In compliance with Act 38, contact individual companies to have utility locations marked in the field and to otherwise locate underground objects as may be necessary prior to the start of construction.
 - 1. Pennsylvania law requires three working days notice for the construction phase and ten working days in design stage. Call Pennsylvania One Call System, Inc. (1-800-242-1776, as of this writing).

1.12 CONTRACT DRAWINGS.

- A. Contract Drawings are diagrammatic and indicate the relation of piping, ductwork, connections and equipment. The Drawings do not indicate all offsets, elbows and fittings that may be required. Therefore, the Contractor shall carefully investigate the structural and finish conditions affecting the work. The Contractor shall provide all offsets, elbows, fittings, hangers and accessories as may be required to meet these conditions at no additional cost to the Owner.
- B. Do not scale the Drawings. The Contractor shall check conditions at the site for dimensions and sizes pertaining to the structure.
- C. Do not deviate from the Drawings without prior approval.

1.13 LINES, GRADES AND SURVEYS.

- A. All necessary surveys, lines, grades and measurements are the responsibility of the Contractor desiring the information for the proper installation of his work. The Contractor is responsible for the proper installation of the work with respect to other Contractors.
- B. Grades, elevations and locations shown on the Drawing are approximate and the Contractor shall check all such information on the site before proceeding with the work.

1.14 WORKMANSHIP.

- A. All equipment, piping, conduit, insulation, fixtures, etc. shall be installed meeting the accepted standards of the representative industry.
- B. All work to be performed shall be done by qualified mechanics. All mechanics in the employ of this Contractor on this project shall be skilled in the phases of the work to which they are used. The mechanic's affiliation with labor organizations shall be acceptable to all trades employed on the project.

1.15 SUBMITTAL PROCEDURES.

- A. Transmit each submittal with an Owner's Representative accepted form. Include one copy each for the Owner and the Owner's Representative in addition to copies required by Contractor.

- B. Sequentially number the transmittal forms. Resubmittals shall have original number with an alphabetic suffix.
 - C. Identify Project, Contractor, Sub-Contractor or Supplier; pertinent drawing sheet and detail number and specification section number, as appropriate.
 - D. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - E. Incomplete submittals shall not relieve the Contractor of providing a complete and functional system.
 - F. Schedule submittals to expedite the Project. Coordinate submission of related items.
 - G. Submittals by the Contractor must be in complete compliance with the Contract Documents unless exceptions are identified. Exceptions to the Contract Documents may only be made to improve the project. Exceptions cannot be taken which would provide an incomplete and/or nonfunctional system.
 - H. Exceptions must be included in/on the submittal in a separate paragraph or drawing block located below the Contractor's stamp identified by the title "Exception to Contract Documents." Exceptions cannot be part of the standard Contractor's stamp.
 - I. Provide space for Contractor and Owner's Representative review stamps.
 - J. The Owner's Representative will return shop drawings with the following designations.
 - 1. Approved: Further submission not required.
 - 2. Approved as Noted: Corrections must be incorporated in final installation. Further submission not required unless specifically noted.
 - 3. Noted: Placed in project files for information only.
 - 4. Revise and Resubmit: Make necessary changes and resubmit prior to fabrication..
 - 5. Not Approved: Does not meet project requirements. Resubmit in accordance with Contract Documents.
 - K. Revise and resubmit submittals as required, identify all changes made since previous submittal.
 - L. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
- 1.16 SHOP DRAWINGS/PRODUCT DATA.
- A. Submit shop drawings and/or catalog cuts for all specified equipment.
 - B. Submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal.
 - C. Mark dimensions and values in units to match those specified.

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- D. Show equipment sizes and locations, by dimensions, of ducts, equipment and other items.
- E. Include wiring diagrams, hole location and sizes and other data that could affect work by other trades.
- F. Show manufacturer's names, trade names, catalog numbers, accessories, special features and rating data.
- G. Indicate required clearances for operating parts, for removal and for servicing.
- H. Show performance data, including pump curves.
- I. Show sound power levels of all rotating equipment.

1.17 SUBSTITUTIONS.

- A. Any bidder wishing to substitute "or equal" equipment may request a substitution. Manufacturers which are submitted as substitutions for approved equal status are considered to have equipment of similar quality; however, the Contractor shall not assume that a piece of equipment by a manufacturer submitted as a "substitution" will be automatically accepted. Compliance with the Drawings and Specifications is still required. If the substituted material is considered to be unacceptable, the Contractor shall provide the equipment as originally specified.
- B. Substitutions are encouraged when there is a significant cost savings or an improvement to the project. Submit reasons for changes with any requests for substitution.
- C. Bid alternates shall be clearly defined on the bid forms in order to be evaluated during the bidding process.
- D. By submitting an alternate or substitution, the Contractor automatically agrees to the following.
- E. The Owner shall be reimbursed by the Contractor for any additional costs incurred by the Owner's Representative to review the substituted materials, in accordance with the then current Owner's Representative's hourly rate.
- F. The Owner shall be reimbursed by the Contractor for any additional costs incurred by the Owner's Representative for field or office conferences caused by the substituted materials shall be paid by the Contractor in accordance with the then current Owner's Representative's hourly rate.
- G. The consideration of alternates/substitutions does not obligate the Owner's Representative to accept same.
- H. In the event a brand is approved and substituted, it is the responsibility of the Contractor to so coordinate his substituted material into the original work at no extra cost to the Owner or any other Contractor.

1.18 CUTTING AND PATCHING.

- A. In new construction, the Contractor shall give the General Contractor complete information as to size of openings required in floors and walls, etc., so that such openings may be provided as the project progresses. In existing construction, the Contractor shall do his own cutting and patching required for the installation of his work.
- B. If openings are omitted or are incorrect through failure of the Contractor to follow these instructions, the Contractor shall, at his own expense, engage the trade which originally installed the work, to cut and patch to the satisfaction of the Owner's Representative.
- C. All cutting and patching of every nature required in connection with this Contract shall be done by the Contractor with mechanics experienced in their respective lines of work. All patching shall match adjacent finishes.
- D. All cutting in the building shall be done with great care so as not to leave an unsightly surface, which may not be concealed by plates, escutcheons or other normal concealing construction. If such unsightly conditions occur, the Contractor shall be required at his own expense, to engage the General Contractor to replace the damaged materials with new materials.

1.19 CONCRETE AND MASONRY WORK.

- A. Unless otherwise noted, all concrete bases, reinforcing, etc. and masonry work required to install the respective Contract Work shall be furnished and installed by the respective Contractor.
- B. The Contractor shall furnish all materials, labor, equipment and tools necessary to complete concrete work.
- C. All concrete work shall comply with the requirements of the ACI Building Code (ACI 318), the ACI Detailing Manual (ACI 315) and the Specifications for Structural Concrete for Buildings (ACI 30).
- D. All reinforcing steel shall be manufactured from high strength billet steel conforming to ASTM Designation A-615, Grade 60. WWF shall comply with ASTM A-185.

1.20 MATERIALS.

- A. All materials and equipment provided by this Contractor shall be new, without imperfections and blemishes and shall be protected from the elements prior to installation in the building.
- B. All equipment shall be tested, listed and labeled by an approved authority (UL, AGA, ETL) and shall be installed in accordance with its listing.
- C. All equipment subject to specific requirements of the Owner's insurance company (gas trains, etc.) shall meet the insurance companies requirements.

1.21 METHODS.

- A. The Plumbing Contractor shall confer with all other Contractors and shall apply for detailed and specific information regarding the location of all equipment as the final location may differ from that indicated on the Drawings. Piping or equipment improperly placed because of the Plumbing Contractor's failure to obtain this information shall be relocated and reinstalled by the Plumbing Contractor without additional expense to the Owner.
- B. Each Contractor, upon request of the Owner's Representative, shall expedite the work of a specific area, section or part of the project to permit the installation of another part of the work.
- C. All piping, accessories and equipment shall be installed in such a manner as to preserve access with sufficient space provided for proper operation and maintenance to any existing equipment or to any new equipment installed under this Specification or under other Specifications or Contracts for this building.
- D. This Contractor shall coordinate his work with that of other trades so that all work may be installed in the most direct manner and so that interference between piping, ducts, equipment, architectural or structural features will be avoided. In the case interference results, the Owner's Representative shall decide which work is to be relocated, regardless of which is first installed. Such relocation shall be at no additional cost to the Owner.
- E. All materials and equipment installed by the Contractor shall be firmly supported and secured to the building structure where required.
- F. All items of labor, material and equipment not specified in detail or shown on the Drawings but incidental to, or necessary for, the complete and proper installation and proper operation of the work described herein or reasonably implied in connection therewith, shall be furnished as if called for in detail by the Specifications or Drawings.
- G. The Contractor shall provide isolation valves and unions or flanges at all pieces of equipment and at all branch take-offs serving five or more pieces of equipment to facilitate replacement or service of the equipment.
- H. All equipment shall be installed in accordance with the manufacturer's recommendations and installation instructions. The manufacturer's installation instructions shall be considered part of this Contract.

1.22 SCHEDULING OF WORK.

- A. The Contractor shall attend all planning meetings, provide scheduling information and work with all trades to obtain a workable project schedule that meets the Owner's requirements.

1.23 PROTECTION.

- A. Each Contractor shall effectively protect his work and materials with tarpaulins or heavy plastic material against dirt, water, chemicals, plaster or damage during the entire period of installation

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or until he is directed to remove the coverings by the Owner's Representative. Any damaged material must be removed and replaced by the Contractor without additional cost regardless of the cause of the damage. All openings in pipes, fittings, etc., must be effectively sealed to exclude dirt, sand and other foreign substances.

1.24 PROTECTION OF OWNER'S EQUIPMENT.

- A. The Contractor shall provide any temporary work required to protect the Owner's equipment and to contain the dust generated during construction. Any measures taken by the Contractor for the protection of equipment shall be installed to the satisfaction of the Owner or the Owner's Representative, which may include any and all provisions listed in DIVISION-1 General Requirements and/or in accordance with the appropriate technical specifications for wood and plastics in DIVISION-6. An approved protection material is nylon reinforced flame retardant and anti-static Griffolyn T-75 ASFR 8 mil film.

1.25 RUBBISH REMOVAL AND CLEAN-UP.

- A. Each Contractor is responsible for periodic removal of all rubbish resulting from his work. All surplus material, refuse, rubbish, etc., shall be removed from the job site at completion of Contract. The Owner's Representative must be satisfied with the removal and clean-up.

1.26 DELIVERING AND STORAGE OF MATERIALS AND EQUIPMENT.

- A. Deliver accessories, small unmarked parts, adhesives and incidental items to site in manufacturer's original, unopened, labeled containers.
- B. Store materials and equipment to prevent damage and injury. Store ferrous materials to prevent rusting. Store equipment to prevent staining and discoloring.

1.27 AS-BUILT DRAWINGS.

- A. During construction, the Contractor shall maintain a record set of installation prints. He shall record on these prints, all deviations from the Contract Drawings in pipe sizing, duct sizing, location and details.
- B. At the completion of the work, the Contractor shall transfer this information neatly onto three sets of prints and forward these prints and the as-built prints to the Owner's Representative.
- C. [At the completion of the work, the Contractor shall transfer this information onto one set of prints and onto computer generated construction documents and forward the as-built prints and an electronic copy to the Owner's Representative. Electronic copies of the plumbing drawings, without title blocks, will be made available to the Contractor in AutoCAD versions 2000 or 2002.]

1.28 OPERATION AND MAINTENANCE INSTRUCTIONS.

- A. Prior to completion of this project, the Contractor shall deliver to the Owner's Representative for approval three copies of an Operating and Maintenance Manual consisting of items outlined hereinafter.
- B. The purpose of this manual is to assist the Owner in routine operation, maintenance, servicing, troubleshooting and procurement of replacement parts. All information in the manual shall be as-built and only material pertinent to the project shall be included.
- C. The manual shall include the following:
 - 1. Manuals shall be bound, 8-1/2 x 11 inch text pages and set in three-ring binders with durable covers.
 - 2. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of project and subject matter of binder when multiple binders are required. All subject matter shall be in typewritten format.
 - 3. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab labeling clearly printed under reinforced laminated plastic tabs.
 - 4. Contents: Prepare a Table of Contents for each volume with product or system description identified, type on white paper.
- D. Part 1: Directory, listing names, addresses and telephone numbers of Owner's Representative, Contractor, Sub-Contractors and major equipment suppliers.
- E. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses and telephone numbers of Sub-Contractors and suppliers. Operating and start-up instructions shall be written in a concise step-by-step manner. Maintenance instructions shall include maintenance schedules, procedures, adjustments and trouble-shooting techniques. All non-pertinent information in the manuals shall be either eliminated or crossed out in a neat and thorough manner. Identify the following.
 - 1. List of equipment.
 - 2. Parts list for each component.
 - 3. Operating instructions.
 - 4. Maintenance instructions for equipment and systems.
- F. Part 3: Project Documents and certificates, including the following:
 - 1. Corrected shop drawings and product data.
 - 2. Control wiring diagrams.
 - 3. Certificates.
 - 4. Photocopies of warranties.
 - 5. Valve tag list.
- G. Submit one copy of completed volumes in final form 30 days prior to final inspection. This copy will be returned after final inspection, with the Owner's Representative's comments. Revise content of documents as required prior to final submittal.

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- H. Submit final volumes revised, within ten days after Owner's review.

1.29 IDENTIFICATION OF MATERIALS AND EQUIPMENT.

- A. Label concealed and exposed piping not more than 25 feet on centers and adjacent to all valves and equipment for easy identification. This does not apply to control compressed air, underground pipe or pipe located within walls. Show flow arrows and medium conveyed in the pipe. Labels shall conform to ANSI A13.1 for color, letter size and marker length.
- B. Identify starters, fans, air conditioning units and other equipment with permanent plates giving name of item, manufacturer's name and operating characteristics.
- C. Show, for items with moving parts, complete information regarding lubricating materials and frequency of lubrication.
- D. Valve tags shall be provided on all valves. Tags shall be two inches in diameter, brass, Style 300-BL as manufactured by Seton Name Plate Corporation. Each tag shall be securely fastened to the valve stem with brass "S" hooks. Additional tags shall be fastened on ceiling tiles or access doors to further identify concealed valves.
- E. Each tag shall be stamped showing the system name, valve identification number, function and position (i.e., N.O., N.C., Balancing Two-Way, Modulating, etc.).
- F. The Contractor shall provide a typewritten valve list segregated by systems, showing valve number, equipment served or system function and location in building by room and nearest column. The list should be on 8-1/2 x 11 inch paper bound in plastic binder and three copies submitted to the Owner or the Owner's Representative for approval and after approval, six copies for final information.

1.30 PAINTING.

- A. Where factory finishes are provided and no additional field painting is specified; all marred or damaged surfaces shall be touched up or refinished to a smooth and uniform finish.
- B. All exposed ferrous metalwork, pipe, supports, hangers, insulation and other surfaces not factory painted shall be painted with one prime and two finish coats. Paint, surface preparation and application shall be as specified in Section: PAINTING. Colors shall match existing work or shall be as selected by the Owner's Representative.

1.31 LAWS, ORDINANCES AND REGULATIONS.

- A. All systems in all and/or part shall conform to all pertinent laws, ordinances and regulations of ALL bodies having jurisdiction, at all governing levels. In case of conflict between governing levels, the more stringent law shall apply. As a minimum, all work shall comply with BOCA, NFPA, OSHA and Pennsylvania Labor and Industry requirements.

- B. The Contractor shall pay all fees, prepare and submit all utility applications and obtain and pay for all permits and inspections required for his work, including L&I pressure vessel installation plans, inspections and approvals.

1.32 BUILDING EXPANSION JOINTS AND FIRE RATED ASSEMBLIES.

- A. Provide expansion joints in piping where they cross building expansion joints.
- B. Meet all requirements of Underwriter's Laboratories and all applicable codes for maintaining the integrity of all fire rated assemblies.

1.33 ACCESS DOORS.

- A. The Contractor shall provide access panels/access doors for access to valves, balancing valves or cocks, water hammer arrestors, cleanouts or any other equipment or component requiring access for maintenance, adjustment or service wherever these items are concealed in building walls, partitions or ceilings. Frames shall be anchored in walls, partitions or ceilings and shall be set true to lines of the building and flush with the finished surfaces. Access panels/access doors shall be as specified in the General Construction Sections of the Specifications.

1.34 FASTENING, SUPPORTS AND HANGERS.

- A. All fastenings, supports, hangers, miscellaneous steel, clamps and anchors shall be type made for specific purpose to be used; toggle bolts or machine bolt fastenings shall be used for hollow tile, terra cotta or lath construction; machine screws shall be used for structural steel fastenings; lead expansion shield and machine screws or lag screws shall be used for solid masonry fastening; lag screws shall be used for wood fastening; all equipment and piping shall be rigidly and firmly installed to prevent swaying, vibrating or sagging by malleable or wrought steel hangers of standard design, pipe clamps or fabricated steel supports of approved design; hangers of horizontal piping runs shall be adjustable clevis type; perforated strap iron hangers and caddy clips are not permissible.

1.35 SOUND PARTITIONS.

- A. Contractor shall be responsible to identify all sound partitions indicated on the architectural plans. Contractor shall seal all penetrations through the wall to maintain the sound absorption integrity of the partition.

1.36 CONCRETE INSERTS.

- A. The Plumbing Contractor shall provide and install concrete inserts of an approved carbon steel wedge-type for all hangers. Where two or more parallel pipes are installed continuous inserts may be used. Where required to distribute the load on the inserts, a piece of reinforcing steel of sufficient length shall be passed through the insert. Each insert shall include a knockout piece. Inserts shall have a minimum safety factor of five.

BASIC PLUMBING REQUIREMENTS

1.37 SLEEVES.

- A. The Plumbing Contractor shall provide and install sleeves where required to protect equipment or facilities in the installation. Each sleeve shall extend through its respective floor, wall, or partition and shall be cut flush with each surface unless otherwise required.
- B. Sleeves in bearing and masonry walls, floors and partitions shall be of standard weight steel pipe finished with smooth edges. For other masonry partitions, through suspended ceilings and for concealed vertical piping, sleeves shall be No. 22 U.S.G. galvanized iron.
- C. All sleeves shall be properly installed and securely cemented in place.
- D. Floor sleeves shall extend one inch above the finished floor. Space between floor sleeves and passing conduit shall be caulked with an approved graphite packing or waterproof caulking compound.
- E. Where pipes pass through waterproofed floors or walls, design of sleeves shall be such that waterproofing can be flashed into and around the sleeves.
- F. Where piping or conduits pass through fire resisting portions of the structure, the annular space between the sleeve and the pipe or conduit shall be filled with an approved fireproof material as required to maintain the fire rating of that portion of the structure. "Firestop Penetrator", or "Proseal Plug Devices" as manufactured by ProSet Systems (or approved equal) shall be used for piping and conduit.
- G. See architectural drawings for fire ratings of building components.

1.38 FIRE STOPPING.

- A. The contractor shall be responsible to provide and install fire-stopping materials and/or systems where his work penetrates fire and/or smoke rated portions of the building and non-fire resistance-rated assemblies. All materials used shall be manufactured such that they are intended to resist the spread of fire and the passage of smoke. This includes but is not limited to rated walls, floors, shafts, ceilings, and non-fire resistance-rated horizontal assemblies. All fire stopping materials used shall have a fire resistance rating equal to or greater than the rated assembly for which they are installed.
- B. For locations where the installed fire stopping material is exposed to normal view, the contractor shall conceal the material with chrome-plated escutcheon plates or other materials that have a flame-spread value of 25 or less and a smoke developed rating of 50 or less, as determined per ASTM E 84. The concealing device shall be approved by the owner's representative prior to installation. Provide shop drawings for each device.
- C. The contractor shall provide components/accessories for each fire-stopping system that are needed to install fill materials and to comply with all system performance requirements as recommended by the fire stopping material manufacturer. Accessories include but are not limited to: mineral wool insulation, ceramic fiber, sealants used to aid in the formation of the fire stopping materials, fire-rated formboard, joint fillers and sealers, collars and steel sleeves.

BASIC PLUMBING REQUIREMENTS

- D. Fire stopping materials and systems shall include, but are not limited to, the following: fire barrier caulk and sealants, intumescent caulk, intumescent putty, intumescent wrap strips, silicone foams and sealants, fire barrier composite sheets and cast-in-place fire barrier systems.
- E. Fire stopping materials and systems shall be as manufactured by 3M Fire Protection Products, Hilti Corporation, or ProSet Systems Inc.

1.39 ANCHOR BOLTS.

- A. The Contractor shall provide and set in place, at the time of pouring of concrete foundations, all necessary anchor bolts as required for the equipment called for in these Specifications. Anchor bolts shall be of the hook type, of proper size and length to suit the equipment. Anchor bolts shall be set in pipe sleeves of approximately twice the bolt diameter and one half the embedded length of the bolt. The Contractor shall assume full responsibility for proper coordination and placement of the bolts. Upon completion of equipment installation, pipe sleeves shall be caulked in accordance with Paragraph, "Sleeves," in this Section of the Specifications.

1.40 WARRANTY

- A. The systems specified herein shall be guaranteed to be free from defects in workmanship and material under normal use and service for a period of one year (five years for all compressors) from date of substantial completion.
- B. If, within the aforementioned warranty period, any of the materials specified herein is proven to be defective in any way, it shall be replaced or repaired at no additional cost to the Owner. The warranty shall include the providing of all labor and materials necessary for repair or replacement of any defective components. The Contractor is responsible for the costs of any services required by equipment suppliers that are not included in the suppliers' warranties.
- C. The Contractor shall, after acceptance of the installation by the Owner or the Owner's Representative, provide any service incidental to the proper performance of the systems under the warranties outlined above for the time periods listed above.

PART 2 – PRODCUTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 220501

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- E. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

- G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Smith, Jay R. Mfg. Co.
 - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description:
 - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 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: Carbon steel.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

- C. Unit has Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Design Mix: 5000 psi, 28-day compressive strength.
- C. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1 inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide ¼ inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants"
- E. Fire-Resistance-Rated Penetrations, Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using grout to seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations, Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:

- a. Piping Smaller Than NPS 6 Galvanized-steel wall sleeves
- 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6 Galvanized-steel wall sleeves with sleeve-seal system .
 - 1) Select sleeve size to allow for 1 inch annular clear space between piping and sleeve for installing sleeve-seal system.
- 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6 : Galvanized-steel-pipe sleeves.
- 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: PVC-pipe sleeves.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Steel Type: With white plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with white finish and spring-clip fasteners.
- C. Split-Casting Brass Type: With polished, white finish and with concealed hinge and setscrew.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners. Split-Casting Floor Plates: White Plated Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

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- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. White Piping: One-piece, cast-brass or split-casting brass type with polished, white finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, white finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, white finish.
 - e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, white finish.
 - f. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor plate.
 - 2. Existing Piping: Split floor plate, floor plate type.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS.

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

1.2 SUMMARY.

- A. Section Includes:

- 1. Bronze ball valves.
- 2. Bronze lift check valves.
- 3. Bronze swing check valves.
- 4. Iron swing check valves.
- 5. Iron center guided check valves.
- 6. Iron gate valves.
- 7. Balancing Valves.
- 8. Drain Valves 9.

- B. Related Sections:

- 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
- 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
- 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS.

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

GENERAL-DUTY VALVES FOR PLUMBING PIPING

1.4 SUBMITTALS.

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE.

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance.
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- 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 hand wheels or stems as lifting or rigging points.

PART 2 - PRODUCTS.

2.1 GENERAL REQUIREMENTS FOR VALVES.

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.

GENERAL-DUTY VALVES FOR PLUMBING PIPING

D. Valve Actuator Types.

1. Handwheel: For valves other than quarter-turn types.
2. Hand lever: For quarter-turn valves NPS 6 and smaller.

E. Valves in Insulated Piping: With valve stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections: Match pipe joining method.

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES.

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Beeco.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Conbraco Industries, Inc.; Apollo Valves.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 200 psig minimum, match plans for greater pressures.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: SOLDER.
 - f. Seats: PTFE or TFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Full.

2.3 BRONZE LIFT CHECK VALVES.

A. Lift Check Valves with Nonmetallic Disc

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig minimum, match plans for greater pressures.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
 - e. Ends: SOLDER.
 - f. Disc: NBR, PTFE, or TFE.

2.4 BRONZE SWING CHECK VALVES.

A. Bronze Swing Check Valves with Bronze or non-metallic Disc

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.
 - b. Kitz Corporation.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-80.
 - b. CWP Rating: 200 psig minimum, match plans for greater pressures.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

2.5 IRON SWING CHECK VALVES.

A. Iron Swing Check Valves with Metal Seats.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following.
 - a. Crane Co.
 - b. Kitz Corporation.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-71.
 - b. CWP Rating: 200 psig minimum, match plans for greater pressures.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Match pipe system.
 - f. Disc: Bronze.

2.6 IRON, CENTER-GUIDED CHECK VALVES.

A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following.
 - a. Crane Co.
 - b. Kitz Corporation.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig minimum, match plans for greater pressures.
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Compact wafer.
 - e. Seat: Bronze.

2.7 IRON GATE VALVES.

A. OS&Y, Iron Gate Valves.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.
 - b. Kitz Corporation.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - g. Beeco.
2. Description:
 - a. Standard: MSS SP-70.
 - b. CWP Rating: 200 psig minimum, match plans for greater pressures.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

2.8 BALANCING VALVES.

A. Copper-Alloy Calibrated Balancing Valves.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITT Industries; Bell & Gossett Div.
 - b. NIBCO INC.
 - c. Taco, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
2. Type: Ball or globe valve with two readout ports and memory setting indicator.
3. Body: bronze.
4. Size: Same as connected piping.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.9 DRAIN VALVES.

A. Ball-Valve-Type, Hose-End Drain Valves.

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP:
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves.

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125:
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 Threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves.

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125:
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

PART 3 - EXECUTION.

3.1 EXAMINATION.

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION.

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install balancing valves in locations where they can easily be adjusted.
- F. Install chainwheels on operators for gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- G. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.3 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.
- B. Set field-adjustable flow set points of balancing valves.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS.

- A. If valve applications are not indicated, use the following.
 - 1. Shutoff Service.
 - a. NPS 3 and smaller: Ball valve.
 - b. NPS 4 and larger: OS&Y gate.
 - 2. Throttling Service: Ball.
 - 3. Sewage and sump basin discharge to have swing check valves with optional lever and weight or lever and spring, for quiet operation.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

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- C. Select valves with the following end connections;
 - 1. NPS 3 and smaller: Match the piping system joining method.
 - 2. NPS 4 and larger: Flanged.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE.

- A. Pipe NPS 3 and Smaller: Bronze ball valves.
- B. Pipe NPS 4 and larger: OS&Y gate valves.

3.6 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE.

- A. Pipe NPS 2 and Smaller: Bronze with threaded ends.
- B. Pipe NPS 3 and larger: Iron with flanged ends.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING 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. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Pipe-positioning systems.
7. Equipment supports.

- B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

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 plumbing 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 and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 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: Pregalvanized, 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 stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube 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 stainless steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-58, 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 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
 - g. Wesanco, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly, for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4,.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

7. Metallic Coating: Electroplated zinc, Hot-dip galvanized, Mill galvanized, or Mechanically deposited zinc.
8. Paint Coating: Vinyl, Epoxy or Polyester.
9. Plastic Coating: PVC, Epoxy or Polyester.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International; a subsidiary of Mueller Water Products Inc.
 - b. Empire Industries, Inc.
 - c. ERICO International Corporation.
 - d. Haydon Corporation; H-Strut Division.
 - e. NIBCO INC.
 - f. PHD Manufacturing, Inc.
 - g. PHS Industries, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturred lips.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
7. Coating: Zinc, Paint or PVC]

2.4 THERMAL HANGER-SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 1. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.
 4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.
 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: : ASTM C 552, Type II cellular glass with 100- psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 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 or 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.

2.6 PIPE-POSITIONING SYSTEMS

- A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.
- B. Stainless Steel: ASTM A240/A240M.
- C. Grout: ASTM C1107/C1107M, 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, 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 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 A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP 89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
- F. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. 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. See Section 077200 "Roof Accessories" for curbs.
- I. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

- J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- L. 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.
- M. Install lateral bracing with pipe hangers and supports to prevent swaying.
- N. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. 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.
- P. 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 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 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: 12 inches long and 0.048 inch thick.
 - 5. Thermal Hanger Shields: Install with insulation of 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 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099123 "Interior Painting."

- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.6 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 finishes.
- 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 corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal hanger-shield inserts for insulated piping and tubing.
- J. 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.
 - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 - 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8
 10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8
 11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 13. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 14. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 15. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 16. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
 17. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
 18. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
 19. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.
- K. 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.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. 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 of up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F 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 piping installations.
- M. 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-joint 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.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 2. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
- O. 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.
 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.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder actuated fasteners or mechanical expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 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 locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness Brass, 0.032-inch Stainless steel, 0.025-inch Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 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-quarters the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black
3. Background Color: White
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 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-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

- B. Letter Color: Red.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 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-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions:
 - 1. Stencil Material: Aluminum.
 - 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.
 1. Tag Material: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link chain or beaded chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
 1. Size: Approximately 4 by 7 inches.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. 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 inaccessible 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 labels.
- C. Pipe Label Color Schedule:
 - 1. Domestic Water Piping
 - a. Background: Yellow.
 - b. Letter Colors: Black.
 - 2. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.
 - 2. Valve-Tag Colors:
 - a. Cold Water: Natural.

b. Hot Water: Natural.

3. Letter Colors:

a. Cold Water: Black.

b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

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 plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.
- C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 - 1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
 - 2. Jacket Materials for Pipe: 12 inches long by NPS 2.
 - 3. Sheet Jacket Materials: 12 inches square.
 - 4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

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 in accordance with ASTM E84 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.
- C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.
 - 1. Piping Mockups:
 - a. One 10-foot section of NPS 2 straight pipe.
 - b. One each of a 90 degree threaded, welded, and flanged elbow.
 - c. One each of a threaded, welded, and flanged tee fitting.
 - d. One NPS 2 or smaller valve and one NPS 2-1/2 or larger valve.
 - e. Four support hangers, including hanger shield and insert.
 - f. One threaded strainer and one flanged strainer with removable portion of insulation.
 - g. One threaded reducer and one welded reducer.
 - h. One pressure temperature tap.
 - i. One mechanical coupling.
 - 2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
 - 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 4. Obtain Architect's approval of mockups before starting insulation application.
 - 5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

7. Demolish and remove mockups when directed.

D. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

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 220529 "Hangers and Supports for Plumbing 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.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

PLUMBING PIPING INSULATION

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pittsburgh Corning Corporation; Foam glass.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 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 in accordance with ASTM C450 and ASTM C585.
- G. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 Deg F 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.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ramco Insulation, Inc.; Super-Stik.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ramco Insulation, Inc.; Thermokote V.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. 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.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
 - 2. 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).
 - 3. 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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70..
 - d. Mon-Eco Industries, Inc.; 22-25.
- D. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70..
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. 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).
 - 3. 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. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive..
2. 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).
3. 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".

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70..
 - b. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: Comply with ASTM E96/E96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 5. Color: White
- C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70..
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 3. Service Temperature Range: 0 to 180 deg F.
 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.

5. Color: White

2.5 LAGGING ADHESIVES

- A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 1. 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).
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - b. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2..
 - c. Vimasco Corporation; 749.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White

2.6 SEALANTS

- A. Joint Sealants:
 1. Joint Sealants for Cellular-Glass and Phenolic Products: Subject to compliance with requirements, provide one of the following
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70..
 - d. Mon-Eco Industries, Inc.; 22-25Color:
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Permanently flexible, elastomeric sealant
 4. Service Temperature Range: Minus 100 to plus 300 deg F.
 5. Color: White or gray.
 6. 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).
 7. 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".

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zest
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmok.
 - d. Speedline Corporation; SmokeSa.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: White.
 - 4. 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.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.

3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
2. ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide with closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

2.11 PROTECTIVE SHIELDING GUARDS

1. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - a. Truebro; a brand of IPS Corporation.
 - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture [hot-water supply] [hot- and cold-water supplies] and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

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.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, 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 storage, 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 attached to structure with vapor-barrier mastic.
 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation 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 beyond damaged areas. Adhere, staple, and seal patches in similar fashion 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. 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 and fire-resistive joint sealers.
- 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, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of 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 that 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 that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 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 2 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, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
 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 that of adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 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 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 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 Fittings and Elbows:

1. Install preformed sections of same material as that of 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.

C. 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 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 Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as that of 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 overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. 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.

3.9 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 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.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Engage a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection 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 if they do not pass tests and inspections.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 1. NPS 1 and Smaller: Insulation shall be[one of] the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot Water:
 1. NPS 1-1/4 and Smaller: Insulation shall be one the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 2. NPS 1-1/2 and Larger: Insulation shall be one the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:

- a. Flexible Elastomeric: 3/4 inch thick.
- b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- c. Polyolefin: 3/4 inch thick.

3.13 INDOOR, 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, Concealed:

1. None.

D. Piping, Exposed:

1. PVC: 20 mils thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Above ground domestic water pipes, tubes, and fittings inside buildings.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Owners' written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

- B. Potable-water piping and components shall comply with NSF 14, NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Cast Copper Unions:
 - 1. MSS SP-123,
 - 2. Cast-copper-alloy, hexagonal-stock body,
 - 3. Ball-and-socket, metal-to-metal seating surfaces
 - 4. Solder-joint or threaded ends.
- G. Copper Pressure-Seal-Joint Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Products Corporation.
 - b. NIBCO Inc.
 - c. Viega.
 - 2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
 - 3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.3 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.

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- d. Jomar International.
 - e. Matco-Norca.
 - f. McDonald, A. Y. Mfg. Co..
 - g. Watts; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.
- 2. Standard: ASSE 1079.
 - 3. Pressure Rating 125 psig minimum at 180 deg F.
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- G. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. 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.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping to permit valve servicing.

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- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 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 pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 INSTALLATION OF TRANSITION FITTINGS

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions:

3.4 INSTALLATION OF DIELECTRIC FITTINGS

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or unions.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs.
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters.
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

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- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

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- a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated:
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Aboveground domestic water piping, NPS 2 and smaller, shall be the following.
 - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, Solder-joint fittings; and soldered joints.
 - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure- sealed joints.

3.12 VALVE SCHEDULE

- A. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller.
 2. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Specialty pipe fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ANACO-Husky.
 - b. Dallas Specialty & Mfg. Co.
 - c. Fernco Inc.
 - d. Matco-Norca, Inc.
 - e. MIFAB, Inc.
 - f. Mission Rubber Company; a division of MCP Industries, Inc.
 - g. Tyler Pipe.
2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

- A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 PVC PIPE AND FITTINGS (Not allowed in plenum spaces)

- A. Schedule 40 PVC pipe: ASTM D2665
- B. Joints and fittings: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.6 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

SANITARY WASTE AND VENT PIPING

3. Shielded, Nonpressure Transition Couplings:

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Mission Rubber Company; a division of MCP Industries, Inc.
 - 3) <Insert manufacturer's name>.
- b. Standard: ASTM C 1460.
- c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- B. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- D. Install piping at indicated slopes.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
 - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
 - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
 - a. Straight tees, elbows, and crosses may be used on vent lines.
 - 3. Do not change direction of flow more than 90 degrees.
 - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
 - a. Reducing size of waste piping in direction of flow is prohibited.

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- H. Lay buried building waste piping beginning at low point of each system.
 - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
 - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
 - 3. Maintain swab in piping and pull past each joint as completed.
- I. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
 - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- J. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- K. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- L. Plumbing Specialties:
 - 1. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 2. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220529 " Hangers and Supports for Plumbing Piping and Equipment."

3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

3.5 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
 - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
 - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.

- c. Inspect joints for leaks.
- 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
 - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch.
 - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
 - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
 - d. Inspect plumbing fixture connections for gas and water leaks.
- 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- 6. Prepare reports for tests and required corrective action.

3.7 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.8 PIPING SCHEDULE

- A. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings, CISPI hubless-piping couplings; and coupled joints..
 - 3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
- B. Aboveground, vent piping NPS 4 and smaller shall be the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
 - 3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
 - 4. Schedule 40 PVC pipe and fittings, solvent weld fittings. (Not allowed in plenum spaces)
- C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil piping, gaskets and gasketed] joints.
 - 2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.
- D. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; coupled joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE 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:
 - 1. Cleanouts.
 - 2. Flashing materials.
 - 3. Miscellaneous sanitary drainage piping specialties.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Cast-Iron Exposed Cleanouts.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Drainage Products.
 - f. Zurn Plumbing Products Group.
 - 2. Standard: ASME A112.36.2M.

SANITARY WASTE PIPING SPECIALTIES

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3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following.
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Smith, Jay R. Mfg. Co. ; Division of Smith Industries, Inc
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products.
 - f. Zurn Plumbing Products Group; Light Commercial Operations.
 - g. Zurn Plumbing Products Group; Specification Drainage Operation.
 - h. Sioux Chief Manufacturing Company, Inc.
2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not Required.
7. Outlet Connection: Inside caulk or threaded.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel bronze.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Medium Duty.
13. Riser: ASTM A74, Service Class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts :

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co. ; Division of Smith Industries, Inc
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast iron soil pipe ts tee as required to match connected piping.

5. Closure Plug: Same as or not more than one size smaller than cleanout size.
6. Closure: Countersunk or raised-head, drilled-and-threaded brass plug
7. Wall Access, Frame and Cover: Round, flat, chrome-plated brass or stainless steel cover plate with screw.

2.2 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Exposed Cast-Iron Exposed Cleanouts.

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as connected drainage piping

B. Air-Gap Fittings.

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

2.3 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated.

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

SANITARY WASTE PIPING SPECIALTIES

1. Size same as drainage piping up to NPS 4 Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- E. Install traps on plumbing specialty drain outlets.

3.2 CONNECTIONS

- A. Install piping adjacent to equipment, to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Commercial, storage, electric-water heaters.
 - 2. Compression tanks.
 - 3. Water heater accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Diagrams for power, signal, and control wiring.
- C. Product Certificates: For each type of commercial electric water heater, signed by product manufacturer.
- D. Manufacturer Seismic Qualification Certification: Submit certification that commercial water heaters, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." 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 unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 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.

- E. Source quality-control test reports.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For electric water heaters to include in emergency, operation, and maintenance manuals,
- H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements".
- C. 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.
- D. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

1.5 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

- A. Refer to Division 01 60 00 Product Requirements specification for warranty registration requirements
- B. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.

- a. Commercial, Electric, Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: Five years.
- b. Compression Tanks: One year.

PART 2 - PRODUCTS

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1. Manufacturers:
 - a. Basis of Design: Bradford White LE340S3-3
 - b. AO Smith
 - c. Rheem
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: UL 1453.
 - 4. Storage-Tank Construction: Non-ASME-code, steel, vertical arrangement.
 - a. Tappings: Factory fabricated materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) Threaded ends in accordance with ASME B1.20.1.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - c. Insulation: Comply with ASHRAE/IES 90.1.
 - d. Jacket: Steel with enameled finish or high-impact composite material.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
 - 6. Special Requirements: NSF 5 construction.

2.2 COMPRESSION TANKS

- A. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank:
1. Manufacturers:
 - a. AMTROL Inc.
 - b. Watts Regulator Co.
 - c. Wessels Co.
 2. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
 3. Capacity and Characteristics:
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: 8 gal. minimum.
 - c. Air Pre-charge Pressure: Matched to system pressure.

2.3 WATER HEATER ACCESSORIES

- A. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
- B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than working-pressure rating.
- C. Purge/Dump Valves: How water heater to be provided with a hose- thread T-port style purge/dump valve directly downstream the water heater on the domestic hot water piping for use during maintenance.
- D. Water Heater Stand and Drain-Pan Units: High-density-polyethylene-plastic, 18-inch- high, enclosed- base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.
- E. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- F. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

- G. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that are capable of isolating each water heater and of providing balanced flow through each water heater.
- H. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- I. Water Regulators: ASSE 1003, water-pressure reducing valve. Set at 25-psig- maximum outlet pressure, unless otherwise indicated.
- J. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

2.4 SOURCE QUALITY CONTROL

- A. Test and inspect water heaters storage tanks, specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial water heater storage before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heater on elevated shelf structurally suitable for carrying at least 1,000 lb.
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install seismic restraints for commercial water heaters. Anchor to substrate.
- D. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install combination temperature and pressure relief valves in water piping for water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters

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that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22, Section 221119 "Domestic Water Piping Specialties."

- G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Division 22, Section 220519 "Meters and Gages for Plumbing Piping."
- H. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Division 22, Section 220519 "Meters and Gages for Plumbing Piping."
- I. Install pressure gage(s) on inlet and outlet of commercial electric water- heater piping. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- J. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve, thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- K. Install water regulator, with integral bypass relief valve, in booster-heater inlet piping and water hammer arrester in booster-heater outlet piping.
- L. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- M. Fill water heaters with water.
- N. Charge compression tanks with air.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections 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, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties
 - a. Replace damaged and malfunctioning controls and equipment and to assist in field testing. Report results in writing

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric water heaters. Refer to Division 01 Section "Demonstration and Training

END OF SECTION 223300

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

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. Water closets.
 - 2. Toilet seats.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:

PART 2 - PRODUCTS

2.1 WATER CLOSETS

- A. Water Closets: Floor mounted, floor outlet, close coupled (gravity tank), vitreous china.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries Model Z5615-BWL or comparable product by one of the following:
 - a. Kohler Co.
 - b. TOTO USA, INC.
 - 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5, and ASSE 1037.
 - b. Bowl Type: Siphon jet.
 - c. Height: ADA/comfort height.
 - d. Rim Contour: Elongated.
 - e. Water Consumption: Water saving.

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- f. Color: White.
- 3. Tank:
 - a. Refer to fixture schedule on drawings for hand lever locations.
- 4. Supply Fittings:
 - a. ASME A112.18.1/CSA B125.1.
 - b. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
 - c. Stop: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.
 - 1. Operation: Loose key.
 - d. Riser:
 - 1. Size: NPS 1/2".
 - 2. Material: Chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided or corrugated stainless steel flexible hose riser.
- 5. Seat: Same as specified for water closets with flush valve.

2.2 TOILET SEATS

A. Toilet Seats:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Industries Model Z595555-AM or comparable product by one of the following:
 - 1. Bemis Manufacturing Company.
 - 2. Church Seats.
 - 3. Olsonite Seat Co.
- 2. Standard: IAPMO/ANSI Z124.5.
- 3. Material: Plastic, anti-microbial protected
- 4. Type: Commercial Standard.
- 5. Shape: Elongated rim, open front.
- 6. Hinge: Self-sustaining.
- 7. Hinge Material: Noncorroding metal.
- 8. Color: White.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Water-Closet Installation:

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1. Install level and plumb according to roughing-in drawings.
2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Install toilet seats on water closets.

D. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.

3.2 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.3 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.4 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

COMMERCIAL WATER CLOSETS

Bucks County Free Library Yardley Branch
Kitchen and Restroom Renovation

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SECTION 224216.13 - COMMERCIAL LAVATORIES

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. Lavatories.
- 2. Faucets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory - Vitreous China, Wall Mounted:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Model Z5340 or comparable product by one of the following:
 - a. Ferguson Enterprises, Inc.; ProFlo Brand.
 - b. Gerber Plumbing Fixtures LLC.
 - c. Kohler Co.
 - d. Mansfield Plumbing Products LLC
 - e. Peerless Pottery Sales, Inc
- 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.

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- b. Type: For wall hanging.
 - c. Nominal Size: 20 by 18 inches.
 - d. Faucet-Hole Punching: 4 inch centers.
 - e. Faucet-Hole Location: Top.
 - f. Color: White.
 - g. Mounting : For concealed arm carrier.
3. Support: ASME A112.6.1M, Type II, concealed arm lavatory carrier with rectangular, steel uprights.

2.2 SOLID BRASS, MANUALLY OPERATED FAUCETS – WALL MOUNTED LAVATORY

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets - Manual Type, two-handle mixing, commercial, solid-brass valve.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Model Z812A4-XL or comparable product by one of the following:
 - a. Bradley Corporation.
 - b. Chicago Faucets.
 - c. Delta Faucet Company.
 - d. Elkay Manufacturing Co.
 - e. Grohe America, Inc
 - f. Just Manufacturing.
 - g. Kohler Co.
 - h. Moen Incorporated.
 - i. Speakman Company.
 - j. T & S Brass and Bronze Works, Inc.
 - 2. Standard: ASME A112.18.1/CSA B125.1.
 - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 - 4. Body Type: Centerset.
 - 5. Body Material: Commercial, solid brass.
 - 6. Finish: Polished chrome plate
 - 7. Maximum Flow Rate: 0.5 gpm.
 - 8. Mounting Type: Deck.
 - 9. Valve Handle(s): Wrist blade, 4 inches.
 - 10. Spout: Swing type.
 - 11. Spout Outlet: Aerator.
 - 12. Drain: Not part of faucet

2.3 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components – Health Effects", for supply-fitting materials that will be in contact with potable water.

- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
 - 1. NPS 3/8.
 - 2. Chrome-plated, soft-copper flexible tube ASME A112.18.6/CSA B125.6, braided- or corrugated-stainless steel, flexible hose riser.

2.4 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 1-1/4.
 - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch thick brass tube to wall or two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch thick brass tube to wall; and chrome-plated, brass or steel wall flange

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lavatories level and plumb in accordance with roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.

COMMERCIAL LAVATORIES

- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. (Fixtures P-6 & P-7. Not required at Fixture P-7 in Toilet Room 516.). Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16 - COMMERCIAL SINKS

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. Breakroom sinks.
 - 2. Sink faucets.
 - 3. Supply fittings.
 - 4. Waste fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data:

PART 2 - PRODUCTS

2.1 SINKS (P-3)

- A. Breakroom Sinks - Stainless Steel, Counter Mounted.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Elkay Model LRAD-1919-65PD and Faucet or comparable product by one of the following:
 - a. Advance Tabco.
 - b. Eagle Group; Foodservice Equipment Division.
 - c. Griffin Products, Inc
 - d. Just Manufacturing.
 - 2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.

COMMERCIAL SINKS

- b. Type: Ledge back.
 - c. Number of Compartments: One
 - d. Overall Dimensions: 25" x 6"
 - e. Material: 18 gauge, stainless steel.
 - f. Compartment:
 - 1) Drain: Grid with NPS 1-1/2 for P 8, tailpiece NPS 1-1/2 tailpiece with dishwasher connection for P 13 and crumb cup with stopper
 - 2) Drain Location: Near back of compartment.
3. Faucet (Basis-of-Design Delta 21996LF-SS):
- a. Chrome plated brass with swing spout.
 - b. Economy aerator.
 - c. Indexed lever handles.
4. Supply Fittings:
- a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
 - 1) Operation: Loose key.
 - 2) Risers: NPS 1/2, chrome-plated, rigid-copper pipe, chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided or corrugated stainless-steel flexible hose
5. Waste Fittings:
- a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Trap(s):
 - 1) Size: NPS 1-1/2.
 - 2) Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch thick brass tube to wall; and chrome-plated brass or steel wall flange.
 - 3) Provide tailpiece with dishwasher connection for P 13.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

COMMERCIAL SINKS

3.2 INSTALLATION

- A. Install sinks level and plumb in accordance with rough-in drawings.
- B. Install water-supply piping with stop on each supply to each sink faucet.
 - 1. Install stops in locations where they can be easily reached for operation.
- C. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- D. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 230501 - BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

- 1.1 Applicable requirements of the Contract Documents, preceding the Technical Specifications, apply to this Section. In the event of conflict between the Specifications, the most stringent shall apply
- 1.2 Separation of these Specifications into Divisions and Sections is for convenience only and is not intended to establish limits of work.
- 1.3 Consult index to be certain that set of Documents and Specifications is complete. Report omissions or discrepancies to the Owner's Representative.
- 1.4 The Contractor shall employ high standards of good workmanship and shall pay special attention to the safety of the equipment. The installation of material and equipment shall be in conformance with the codes and standards listed in Paragraph: STANDARDS. The agency having the most stringent requirements shall be adhered to.
- 1.5 The Contractor shall make a thorough examination of the site and shall make due allowances for difficulties and contingencies to be encountered. All dimensions shall be checked and verified by the Contractor at the site.
- 1.6 The Contractor and all Sub-Contractors shall have a minimum of three years proven experience on projects with similar levels of complexity and magnitude. Experience shall be based on the experience as a company and not on the experience as individuals.
- 1.7 The Drawings and Specifications are intended to function as a common set of documents. Anything shown on the Drawings but not mentioned in the Specifications or mentioned in the Specifications and not shown on the Drawings shall be equally binding as if both noted on the Drawings and called for in the Specifications.
- 1.8 SCOPE.
 - A. The work covered by and included in these Specifications consists of the furnishing of all materials, all equipment, labor, tools and supervision and performing all operations necessary for the proper and complete execution of the Heating, Ventilating and Air Conditioning work in strict accordance with the Specifications and the Drawings and subject to the terms and conditions of the Contract.

BASIC HVAC REQUIREMENTS

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1.9 DEFINITIONS.

- A. The term "Contractor" or "HVAC Contractor" or "Mechanical Contractor" when used in this Specification refers to the Contractor responsible for all work under this Section.
- B. The term "Provide" refers to this Contractor purchasing, delivering and installing as a part of this Contract.
- C. The term "HVAC" refers to Heating, Ventilating and Air Conditioning.
- D. The term "ATC" refers to Automatic Temperature Controls.

1.10 STANDARDS.

- A. Meet requirements and recommendations of applicable portions of the latest edition of all codes and standards, as adopted by the local authority having jurisdiction, including those listed.
 - 1. Air Movement and Control Association Standards (AMCA).
 - a. 210 Laboratory Methods of Testing Fans for Rating Purposes
 - 2. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE).
 - a. 52 Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
 - b. 90-1 Energy Efficient Design for New Building.
 - 3. American National Standards Institute Standards (ANSI).
 - a. ANSI/ASME B16.5 Pipe Flanges and Flanged Fittings
 - b. ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - c. ANSI/ASME B31.1 Power Piping.
 - 4. American Society of Mechanical Engineers (ASME).
 - a. Boiler and Pressure Vessel Code and Interpretations Section VIII; Unfired Pressure Vessels (latest edition with addenda).
 - 5. American Society for Testing and Materials Standards (ASTM).
 - a. A-18 Carbon Steel Forgings For General Purpose Piping.
 - b. A-234 Piping Fittings of Wrought Carbon Steel and Alloy Steel For Moderate and High Temperature Service.
 - c. A-53 Welded and Seamless Steel Pipe.
 - d. B-88 Seamless Copper Water Tube
 - e. E-84 Surface Burning Characteristics of Building Materials.

- f. C-411 Test Method for Hot Surface Performance of High Temperature Thermal Insulation
- 6. American Welding Society Standards (AWS).
 - a. B3.0 Qualification Procedure.
- 7. 2015 Uniform Construction Code - State of PA (PA-UCC).
- 8. 2018 NJ Uniform Construction Code (NJ-UCC).
- 9. Pennsylvania Code Title 34, Labor and Industry.
- 10. 2015 [2018] International Building Code (IBC).
- 11. 2015 [2018] International Mechanical Code (IMC).
- 12. 2015 [2018] International Energy Conservation Code (IECC).
- 13. NFPA 101 Code for Safety to Life from Fire in Buildings and Structures.
- 14. National Fire Protection Association Standards (NFPA).
 - a. 70 National Electrical Code (NEC).
 - b. 90A Installation of Air Conditioning and Ventilating Systems.
 - c. 96 Ventilation Control and Fire Protection of Commercial Cooking Operations.
 - d. 255 Surface Burning Characteristics of Building Materials.
- 15. Occupational Safety and Health Administration (OSHA).
- 16. Public Law 101-336, The Americans with Disabilities Act of 1990.
- 17. Sheet Metal and Air Conditioning Contractors National Association, Inc., Publication (SMACNA).
 - a. HVAC Duct Construction Standards: Metal and Flexible, Second Edition.
 - b. Seismic Restraint Manual: Guidelines For Mechanical Systems, Second Edition.
- 18. Air Conditioning and Refrigeration Institute (ARI).
 - a. ANSI/ARI 210/240 - Unitary Air Conditioning Equipment and Air Source Heat Pump Equipment.
 - b. ANSI/ARI 410 - Forced Circulation Air-Cooling and Air-Heating Coils
 - c. ANSI/ARI 430 - Central Station Air Handling Units.
 - d. ANSI/ARI 550 - Centrifugal and Rotary Screw Water-Chilling Packages.
- 19. Underwriters Laboratories Publication (UL).
 - a. 1025 - Electric Air Heaters.
 - b. 1995 - Heating and Cooling Equipment.
- B. Should any change in the Drawings and/or Specifications be required to conform to the codes, ordinances, regulations or laws mentioned above, the Owner's Representative shall be notified prior to the time of submitting bids.

1.11 NOTIFICATION.

- A. Trades that have work connected with the heating, ventilating and air conditioning work and trades that do preparatory work for heating, ventilating and air conditioning shall be notified for installation requirements and scheduling.
- B. The Owner's Representative shall be informed of the installation schedule to allow sufficient time for inspection without any work delay.
- C. All work shall be coordinated to avoid cutting of work in place and interfering with other operations.
- D. In compliance with Act 38, contact individual companies to have utility locations marked in the field and to otherwise locate underground objects as may be necessary prior to the start of construction.
 - 1. Pennsylvania law requires three working days notice for the construction phase and ten working days in design stage. Call Pennsylvania One Call System, Inc. (1-800-242-1776, as of this writing).

1.12 CONTRACT DRAWINGS.

- A. Contract Drawings are diagrammatic and indicate the relation of piping, ductwork, connections and equipment. The Drawings do not indicate all offsets, elbows and fittings that may be required. Therefore, the Contractor shall carefully investigate the structural and finish conditions affecting the work. The Contractor shall furnish all offsets, elbows, fittings, hangers and accessories as may be required to meet these conditions at no additional cost to the Owner.
- B. Do not scale the Drawings. The Contractor shall check conditions at the site for dimensions and sizes pertaining to the structure.
- C. Do not deviate from the Drawings without prior approval.

1.13 LINES, GRADES AND SURVEYS.

- A. All necessary surveys, lines, grades and measurements are the responsibility of the Contractor desiring the information for the proper installation of his work. The Contractor is responsible for the proper installation of the work with respect to other Contractors.
- B. Grades, elevations and locations shown on the Drawings are approximate and the Contractor shall check all such information on the site before proceeding with the work.

1.14 WORKMANSHIP

- A. All equipment, piping, conduit, insulation, fixtures, etc. shall be installed meeting the accepted standards of the representative industry.

- B. All work to be performed shall be done by qualified mechanics. All mechanics in the employ of this Contractor on this project shall be skilled in the phases of the work to which they are used. The mechanic's affiliation with labor organizations shall be acceptable to all trades employed on the project.

1.15 SUBMITTAL PROCEDURES.

- A. Transmit each submittal with an Owner's Representative's accepted form. Include one copy each for the Owner and the Owner's Representative in addition to copies required by the Contractor.
- B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphabetic suffix.
- C. Identify Project, Contractor, Sub-Contractor or Supplier; pertinent Drawing sheet and detail number and Specification Section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work and coordination of information is in accordance with the requirements of the work and Contract Documents.
- E. Incomplete submittals shall not relieve the Contractor of providing a complete and functional system.
- F. Schedule submittals to expedite the Project. Coordinate submission of related items.
- G. Submittals by the Contractor must be in complete compliance with the Contract Documents unless exceptions are identified. Exceptions to the Contract Documents may only be made to improve the project. Exceptions cannot be taken which would provide an incomplete and/or nonfunctional system.
- H. Exceptions must be included in/on the submittal in a separate paragraph or drawing block located below the Contractor's stamp identified by the title "Exception to Contract Documents." Exceptions cannot be part of the standard Contractor's stamp.
- I. Provide space for Contractor and Owner's Representative review stamps.
- J. The Owner's Representative will return Shop Drawings with the following designations.
 - 1. Approved: Further submission not required.
 - 2. Approved as Noted: Corrections must be incorporated in final installation. Further submission not required unless specifically noted.
 - 3. Noted: Placed in project files for information only.
 - 4. Revise and Resubmit: Make necessary changes and resubmit prior to fabrication.
 - 5. Not Approved: Does not meet project requirements. Resubmit in accordance with Contract Documents.
- K. Revise and resubmit submittals as required, identify all changes made since previous submittal.

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- L. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.16 SHOP DRAWINGS/PRODUCT DATA.

- A. Submit manufacturer's installation instructions.
- B. Submit Shop Drawings and/or catalog cuts for all specified materials and equipment, piping layouts and ductwork layouts.
- C. Submit Shop Drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal.
- D. Mark dimensions and values in units to match those specified.
- E. Show equipment sizes and locations, by dimensions, of ducts, equipment and other items.
- F. Include wiring diagrams, hole location and sizes and other data that could affect work by other trades.
- G. Show manufacturer's names, trade names, catalog numbers, accessories, special features and rating data.
- H. Indicate required clearances for operating parts, for removal and for servicing.
- I. Show performance data, including fan and pump curves.
- J. Show sound power levels of all rotating equipment.
- K. Indicate efficiencies and air leakage rates for filters and filter housings.

1.17 SUBSTITUTIONS.

- A. Any bidder wishing to substitute "or equal" equipment may request a substitution. Manufacturers which are submitted as substitutions for approved equal status are considered to have equipment of similar quality; however, the Contractor shall not assume that a piece of equipment by a manufacturer submitted as a "substitution" will be automatically accepted. Compliance with the Drawings and Specifications is still required. If the substituted material is considered to be unacceptable, the Contractor shall provide the equipment as originally specified.
- B. Substitutions are encouraged when there is significant cost savings or an improvement to project. Submit reasons for changes with any requests for substitution. All requests for substitutions must be made within 30 days of contract award unless stated otherwise in the General Conditions.
- C. Bid alternates shall be clearly defined on the bid forms in order to be evaluated during the bidding process.
- D. By submitting an alternate or substitution, the Contractor automatically agrees to the following:

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1. The Owner shall be reimbursed by the Contractor for any additional costs incurred by the Owner's Representative to review the substituted materials, in accordance with the then current Owner's Representative's hourly rate
2. The Owner shall be reimbursed by the Contractor for any additional costs incurred by the Owner's Representative for field or office conferences caused by the substituted materials in accordance with the then current Owner's Representative's hourly rate.
3. The consideration of alternates/substitutions does not obligate the Owner's Representative to accept same.
4. In the event a brand is approved and substituted, it is the responsibility of the Contractor to so coordinate his substituted material into the original work at no extra cost to the Owner or any other Contractor.

1.18 CUTTING AND PATCHING.

- A. In new construction, the Contractor shall give the General Contractor complete information as to size of openings required in floors and walls, etc., so that such openings may be provided as the project progresses. In existing construction, the Contractor shall do his own cutting and patching required for the installation of his work.
- B. If openings are omitted or are incorrect through failure of the Contractor to follow these instructions, the Contractor shall, at his own expense, engage the trade, which originally installed the work, to cut and patch to the satisfaction of the Owner's Representative.
- C. All cutting and patching of every nature required in connection with this Contract shall be done by the Contractor with mechanics experienced in their respective lines of work. All patching shall match adjacent finishes.
- D. All cutting in the building shall be done with great care so as not to leave an unsightly surface, which may not be concealed by plates, escutcheons or other normal concealing construction. If such unsightly conditions occur, the Contractor shall be required, at his own expense, to engage the General Contractor to replace the damaged materials with new materials.

1.19 CONCRETE AND MASONRY WORK.

- A. Unless otherwise noted, all concrete bases, reinforcing, etc. and masonry work required to install the respective Contract Work shall be furnished and installed by the respective Contractor.
- B. The Contractor shall furnish all materials, labor, equipment and tools necessary to complete concrete work.
- C. Contractor shall provide minimum of four inch thick concrete bases under all floor mounted equipment.
- D. All concrete work shall comply with the requirements of the ACI Building Code (ACI 318), the ACI Detailing Manual (ACI 315) and the Specifications for Structural Concrete for Buildings (ACI 301)

- E. All reinforcing steel shall be manufactured from high strength billet steel conforming to ASTM Designation A-615, Grade 60. WWF shall comply with ASTM A-185.

1.20 MATERIALS.

- A. All materials and equipment provided by this Contractor shall be new, without imperfections and blemishes and shall be protected from the elements prior to installation in building.
- B. All equipment shall be tested, listed and labeled by an approved authority (UL, AGA, ETL) and shall be installed in accordance with its listing. Installation instructions shall be available at the job site.
- C. All equipment subject to specific requirements of the Owner's insurance company (gas trains, etc.) shall meet the insurance companies' requirements.

1.21 METHODS.

- A. The HVAC Contractor shall confer with all other Contractors and shall apply for detailed and specific information regarding the location of all equipment as the final location may differ from that indicated on the Drawings. Ductwork, piping or equipment improperly placed because of the HVAC Contractor's failure to obtain this information shall be relocated and reinstalled by the HVAC Contractor without additional expense to the Owner.
- B. Each Contractor, upon request of the Owner's Representative shall expedite the work of a specific area, section or part of the project to permit the installation of another part of the work.
- C. All ductwork, piping, accessories and equipment shall be installed in such a manner as to preserve access with sufficient space provided for proper operation and maintenance to any existing equipment or to any new equipment installed under this Specification or under other Specifications or Contracts for this building.
- D. This Contractor shall coordinate his work with that of other trades so that all work may be installed in the most direct manner and so that interference between piping, ducts, equipment, architectural or structural features will be avoided. In the case interference results, the Owner's Representative shall decide which work is to be relocated, regardless of which is first installed. Such relocation shall be at no additional cost to the Owner.
- E. All materials and equipment installed by the Contractor shall be firmly supported and secured to the building structure where required.
- F. All items of labor, material and equipment not specified in detail or shown on the Drawings but incidental to, or necessary for, the complete and proper installation and proper operation of the work described herein or reasonably implied in connection therewith, shall be furnished as if called for in detail by the Specifications or Drawings.

- G. The Contractor shall provide isolation valves and unions or flanges at all pieces of equipment and at all branch take-offs serving five or more pieces of equipment (whether indicated or not) to facilitate replacement or service of the equipment.
- H. All equipment shall be installed in accordance with the manufacturer's recommendations and installation instructions. The manufacturer's installation instructions shall be considered part of this Contract.

1.22 SCHEDULING OF WORK.

- A. The Contractor shall attend all planning meetings, provide scheduling information and work with all trades to obtain a workable project schedule that meets the Owner's requirements.

1.23 PROTECTION.

- A. Each Contractor shall effectively protect his work and materials with tarpaulins or heavy plastic material against dirt, water, chemicals, plaster or damage during the entire period of installation or until he is directed to remove the coverings by the Owner's Representative. Any damaged material must be removed and replaced by the Contractor without additional cost regardless of the cause of the damage. All openings in pipes, fittings, ductwork, etc. must be effectively sealed to exclude dirt, sand and other foreign substances.

1.24 PROTECTION OF OWNER'S EQUIPMENT.

- A. The Contractor shall provide any temporary work required to protect the Owner's equipment and to contain the dust generated during construction. Any measures taken by the Contractor for the protection of equipment shall be installed to the satisfaction of the Owner or the Owner's Representative, which may include any and all provisions listed in DIVISION-1: GENERAL REQUIREMENTS and/or in accordance with the appropriate Technical Specifications for wood and plastics in DIVISION-6. An approved protection material is nylon reinforced flame retardant and anti-static Griffolyn T-55 ASFR 8 mil film. Telephone No. 1-800-231-6074.

1.25 RUBBISH REMOVAL AND CLEANUP.

- A. Each Contractor is responsible for periodic removal of all rubbish resulting from his work. All surplus material, refuse, rubbish, etc., shall be removed from the job site at completion of Contract. The Owner's Representative must be satisfied with the removal and cleanup.

1.26 DELIVERING AND STORAGE OF MATERIALS AND EQUIPMENT.

- A. Deliver accessories, small-unmarked parts, adhesives and incidental items to the site in manufacturer's original, unopened, labeled containers.
- B. Store materials and equipment to prevent damage and injury. Store ferrous materials to prevent rusting. Store equipment to prevent staining and discoloring.

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1.27 AS-BUILT DRAWINGS.

- A. During construction, the Contractor shall maintain a record set of red lined installation prints. He shall record on these prints, all deviations from the Contract Drawings in pipe sizing, duct sizing, equipment, pipe or duct location, depth of pipe cover and details.
- B. At the completion of the work, the Contractor shall transfer this information neatly onto sepias and forward these sepias and the as-built prints to the Owner's Representative.
- C. [At the completion of the work, the Contractor shall transfer this information onto one set of prints and onto computer generated construction documents and forward the as-built prints and an electronic copy to the Owner's Representative. Electronic copies of mechanical drawings, without title blocks, will be made available to the Contractor in AutoCAD versions 2000 or 2002].

1.28 OPERATION AND MAINTENANCE INSTRUCTIONS.

- A. Prior to completion of this project, the Contractor shall deliver to the Owner's Representative for approval three copies of an Operating and Maintenance Manual consisting of items outlined hereinafter.
- B. The purpose of this manual is to assist the Owner in routine operation, maintenance, servicing, troubleshooting and procurement of replacement parts. All information in the manual shall be as-built and only material pertinent to the project shall be included.
- C. The manual shall include the following:
 - 1. Manuals shall be bound, 8-1/2 x 11 inch text pages and set in three-ring binders with durable covers.
 - 2. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of project and subject matter of binder when multiple binders are required. All subject matter shall be in typewritten format.
 - 3. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab labeling clearly printed under reinforced laminated plastic tabs.
 - 4. Contents: Prepare a Table of Contents for each volume with product or system description identified, type on white paper.
 - 5. Part 1: Directory, listing names, addresses and telephone numbers of Owner's Representative, Contractor, Sub-Contractors and major equipment suppliers.
 - 6. Part 2: Operation and maintenance instructions, arranged by system and subdivided by Specification Section. For each category, identify names, addresses and telephone numbers of Sub-Contractors and suppliers. Operating and start-up instructions shall be written in a concise step-by-step manner. Maintenance instructions shall include maintenance schedules, procedures, adjustments and troubleshooting techniques. All non-pertinent information in the manuals shall be either eliminated or crossed out in a neat and thorough manner. Identify the following.
 - a. List of equipment.
 - b. Parts list for each component.

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- c. Operating instructions.
 - d. Maintenance instructions for equipment and systems.
7. Part 3: Project documents and certificates, including the following:
- a. Corrected shop drawings and product data.
 - b. Control wiring diagrams.
 - c. Certificates.
 - d. Photocopies of warranties
 - e. Valve tag list.
8. Submit one copy of completed volumes in final form 30 days prior to final inspection. This copy will be returned after final inspection, with the Owner's Representative's comments. Revise content of documents as required prior to final submittal.
9. Submit final volumes revised, within ten days after Owner's review.

1.29 IDENTIFICATION OF MATERIALS AND EQUIPMENT.

- A. Label concealed and exposed piping not more than 25 feet on centers and adjacent to all valves and equipment for easy identification. This does not apply to control compressed air, underground pipe or pipe located within walls. Show flow arrows and medium conveyed in the pipe. Labels shall conform to ANSI A13.1 for color, letter size and marker length.
- B. Identify starters, fans, air conditioning units and other equipment with permanent plates giving name of item, manufacturer's name and operating characteristics.
- C. Show, for items with moving parts, complete information regarding lubricating materials and frequency of lubrication.
- D. Valve tags shall be provided on all valves. Tags shall be two inches in diameter, brass, Style 300-BL as manufactured by Seton Name Plate Corporation. Each tag shall be securely fastened to the valve stem with brass "S" hooks. Additional tags shall be fastened on ceiling tiles or access doors to further identify concealed valves.
- E. Each tag shall be stamped showing the system name, valve identification number, function and position (i.e., N.O., N.C., Balancing Two-Way, Modulating, etc).
- F. The Contractor shall provide a typewritten valve list segregated by systems, showing valve number, equipment served or system function and location in building by room and nearest column. The list should be on 8-1/2 x 11 inch paper bound in plastic binder and three copies submitted to the Owner or the Owner's Representative for approval and after approval, six copies for final information.

1.30 PAINTING.

- A. Where factory finishes are provided and no additional field painting is specified; all marred or damaged surfaces shall be touched up or refinished to a smooth and uniform finish.

- B. All exposed ferrous metalwork, pipe, supports, hangers, insulation, exterior equipment including aluminum and other surfaces not factory painted shall be painted with one prime and two finish coats. Paint, surface preparation and application shall be as specified in Section: PAINTING. Colors shall match existing work or shall be as selected by the Owner's Representative.

1.31 LAWS, ORDINANCES AND REGULATIONS.

- A. All systems in all and/or part shall conform to all pertinent laws, ordinances and regulations of ALL bodies having jurisdiction, at all governing levels. In case of conflict between governing levels, the more stringent law shall apply. As a minimum, all work shall comply with BOCA Mechanical Code, NFPA, OSHA, SMACNA and Pennsylvania Labor & Industry requirements.
- B. The Contractor shall pay all fees, prepare and submit all utility applications and obtain and pay for all permits and inspections required for his work including L&I boiler room plans and L&I inspections and approvals.

1.32 BUILDING EXPANSION JOINTS AND FIRE RATED ASSEMBLIES.

- A. Provide expansion joints in ductwork and piping where they cross building expansion joints.
- B. Provide fire dampers in all penetrations through fire rated floors, walls and partitions and provide ceiling radiation dampers in penetrations through fire rated ceiling assemblies as required to maintain the necessary fire rating and/or UL rating of the assembly.
- C. Meet all requirements of Underwriter's Laboratories and all applicable codes for maintaining the integrity of all fire rated assemblies.
- D. Seal space around ducts, pipes or conduits with approved fireproof material where they pass through fire rated assemblies.

1.33 ACCESS DOORS.

- A. The Contractor shall provide access panels/access doors for access to dampers, valves, controllers or any other equipment or component requiring access for maintenance, adjustment or service wherever these items are concealed in building walls, partitions or ceilings. Frames shall be anchored in walls, partitions or ceilings and shall be set true to lines of the building and flush with the finished surfaces. Access panels/access doors shall be as specified in the General Construction Sections of the Specifications.

1.34 FASTENING, SUPPORTS AND HANGERS.

- A. All fastenings, supports, hangers, miscellaneous steel, clamps and anchors shall be of the type made for the specific purpose for which they are to be used. Toggle bolts or machine bolt fastenings shall be used for hollow tile, terra cotta or lath construction. Machine screws shall be used for structural steel fastenings. Lead expansion shield and machine screws or lag screws shall

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be used for solid masonry fastening. Lag screws shall be used for wood fastening. All equipment, piping and ductwork shall be rigidly and firmly installed to prevent swaying, vibrating or sagging by malleable or wrought steel hangers of standard design, pipe clamps or fabricated steel supports of approved design. Hangers of horizontal piping runs shall be adjustable clevis-type. Perforated strap iron hangers and caddy clips are not permissible

1.35 SOUND PARTITIONS.

- A. Contractor shall be responsible to identify all sound partitions indicated on the architectural plans. Contractor shall seal all penetrations through the wall to maintain the sound absorption integrity of the partition.

1.36 CONCRETE INSERTS.

- A. The HVAC Contractor shall provide and install concrete inserts of an approved carbon steel wedge-type for all hangers. Where two or more parallel pipes are installed continuous inserts may be used. Where required to distribute the load on the inserts, a piece of reinforcing steel of sufficient length shall be passed through the insert. Each insert shall include a knockout piece. Inserts shall have a minimum safety factor of five.

1.37 SLEEVES.

- A. The HVAC Contractor shall provide and install sleeves where required to protect equipment or facilities in the installation. Each sleeve shall extend through its respective floor, wall or partition and shall be cut flush with each surface unless otherwise required.
- B. Sleeves in bearing and masonry walls, floors and partitions shall be of standard weight steel pipe, finished with smooth edges. For other masonry partitions, through suspended ceilings and for concealed vertical piping, sleeves shall be No. 22 U.S.G. galvanized iron.
- C. All sleeves shall be properly installed and securely cemented in place.
- D. Floor sleeves shall extend one inch above the finished floor. Space between floor sleeves and passing conduit shall be caulked with an approved graphite packing or waterproof caulking compound.
- E. Where pipes pass through waterproofed floors or walls, design of sleeves shall be such that waterproofing can be flashed into and around the sleeves.
- F. Where pipes, ducts or conduits pass through fire resisting portions of the structure, the annular space between the sleeve and the pipe, duct or conduit shall be filled with an approved fireproof material as required to maintain the fire rating of that portion of the structure. "Firestop Penetrator," or "Proseal Plug Devices" as manufactured by ProSet Systems (or approved equal) shall be used for piping and conduit
- G. See architectural drawings for fire ratings of building components.

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1.38 FIRE STOPPING.

- A. The contractor shall be responsible to provide and install fire-stopping materials and/or systems where his work penetrates fire and/or smoke rated portions of the building and non-fire resistance-rated assemblies. All materials used shall be manufactured such that they are intended to resist the spread of fire and the passage of smoke. This includes but is not limited to rated walls, floors, shafts, ceilings, and non-fire resistance-rated horizontal assemblies. All fire stopping materials used shall have a fire resistance rating equal to or greater than the rated assembly for which they are installed.
- B. For locations where the installed fire stopping material is exposed to normal view, the contractor shall conceal the material with chrome-plated escutcheon plates or other materials that have a flame-spread value of 25 or less and a smoke developed rating of 50 or less, as determined per ASTM E 84. The concealing device shall be approved by the owner's representative prior to installation. Provide shop drawings for each device.
- C. The contractor shall provide components/accessories for each fire-stopping system that are needed to install fill materials and to comply with all system performance requirements as recommended by the fire stopping material manufacturer. Accessories include but are not limited to: mineral wool insulation, ceramic fiber, sealants used to aid in the formation of the fire stopping materials, fire-rated formboard, joint fillers and sealers, collars and steel sleeves.
- D. Fire stopping materials and systems shall include, but are not limited to, the following: fire barrier caulk and sealants, intumescent caulk, intumescent putty, intumescent wrap strips, silicone foams and sealants, fire barrier composite sheets and cast-in-place fire barrier systems.
- E. Fire stopping materials and systems shall be as manufactured by 3M Fire Protection Products, Hilti Corporation, or ProSet Systems Inc.

1.39 ANCHOR BOLTS.

- A. The Contractor shall provide and set in place, at the time of pouring of concrete foundations, all necessary anchor bolts as required for the equipment called for in these Specifications. Anchor bolts shall be of the hook-type, of proper size and length to suit the equipment. Anchor bolts shall be set in pipe sleeves of approximately twice the bolt diameter and one half the embedded length of the bolt. The Contractor shall assume full responsibility for proper coordination and placement of the bolts. Upon completion of equipment installation, pipe sleeves shall be caulked in accordance with Paragraph: "SLEEVES" in this Section of the Specifications.

1.40 WARRANTY.

- A. The systems specified herein shall be guaranteed to be free from defects in workmanship and material under normal use and service for a period of one year (five years for all compressors) from date of substantial completion.
- B. If, within the aforementioned warranty period, any material specified herein is proven to be defective in any way, it shall be replaced or repaired at no additional cost to the Owner. Warranty

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shall include providing of all labor and materials necessary for repair or replacement of any defective components. The Contractor is responsible for costs of any services required by equipment suppliers that are not included in suppliers' warranties.

- C. The Contractor shall, after acceptance of the installation by the Owner or the Owner's Representative, provide any service incidental to the proper performance of the systems under the warranties outlined above for the time periods listed above.

PART 2 – PRODCUTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 230501

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 alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. 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 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 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Testing, Adjusting, and Balancing of Air Systems:
 - a. Constant-volume air systems.
 - 2. Testing, adjusting, and balancing of existing HVAC systems and equipment.

1.3 DEFINITIONS.

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.
- G. UFAD: Underfloor air distribution.

1.4 PREINSTALLATION MEETINGS

- A. TAB Conference: Conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan, to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
 - 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.

- c. Needs for coordination and cooperation of trades and subcontractors.
- d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 90 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 90 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.
- C. Strategies and Procedures Plan: Within 90 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 90 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.6 QUALITY ASSURANCE

- A. TAB Specialists Qualifications, Certified by AABC:
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC.
- B. TAB Specialists Qualifications, Certified by NEBB or TABB:
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB.
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

- D. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, available TAB specialists that may be engaged include, but are not limited to, the following:
 - 1. Air Balancing Engineers, Inc.
 - 2. Butler Balancing
 - 3. Eastern Air Balance Corporation

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 TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.
- F. Examine equipment performance data, including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

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- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
- L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. 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 in accordance with the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's

"Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

- B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB 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 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

- A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
 - 1. Fans and ventilators.
 - 2. Rooftop air-conditioning units.

3.6 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' Record drawings duct layouts.
- C. 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. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.

3.7 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan and equipment with fan(s).
 - 2. Measure and record flows, temperatures, and pressures of each piece of equipment in each hydronic system. Compare the values to design or nameplate information, where information is available.
 - 3. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 4. Check the refrigerant charge.
 - 5. Check the condition of filters.
 - 6. Check the condition of coils.
 - 7. Check the operation of the drain pan and condensate-drain trap.
 - 8. Check bearings and other lubricated parts for proper lubrication.
 - 9. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. TAB After Construction: Before performing testing and balancing of renovated existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished in accordance with renovation scope indicated by Contract Documents. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.
 - 4. Fans are clean.
 - 5. Bearings and other parts are properly lubricated.
 - 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
 - 1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 - 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 - 3. If calculations increase or decrease the airflow rates and water flow rates by more than 5percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5percent or less, equipment adjustments are not required.
 - 4. Balance each air outlet.

3.8 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent. If design value is less than 100 cfm, within 10 cfm.
 2. Air Outlets and Inlets: Plus or minus 5 percent. If design value is less than 100 cfm within 10 cfm
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.9 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
 2. Manufacturers' test data.
 3. Field test reports prepared by system and equipment installers.
 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.

8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents, including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans performance forms, including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Heating coil, dry-bulb conditions.
 - e. Face and bypass damper settings at coils.
 - f. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - g. Settings for variable-air-volume systems.
 - h. Settings for pressure controller(s).
 - i. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Duct, outlet, and inlet sizes.
 3. Terminal units.
 4. Balancing stations.
 5. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.

2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and speed.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches
3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm
 - b. Total system static pressure in inches wg.
 - c. Fan speed.
 - d. Inlet and discharge static pressure in inches wg
 - e. For each filter bank, filter static-pressure differential in inches wg
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg
 - h. Heating-coil static-pressure differential in inches wg
 - i. List for each internal component with pressure-drop, static-pressure differential in inches wg
 - j. Outdoor airflow in cfm.
 - k. Return airflow in cfm.
 - l. Outdoor-air damper position.
 - m. Return-air damper position.
 - n. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft.
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.

- f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Refrigerant expansion valve and refrigerant types.
 - i. Refrigerant suction pressure in psig.
 - j. Refrigerant suction temperature in deg F.
- G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
 - 1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Fuel type in input data.
 - g. Output capacity in Btu/h.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Motor horsepower and speed.
 - k. Motor volts, phase, and hertz.
 - l. Motor full-load amperage and service factor.
 - m. Sheave make, size in inches, and bore.
 - n. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - 2. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Entering-air temperature in deg F.
 - c. Leaving-air temperature in deg F.
 - d. Air temperature differential in deg F.
 - e. Entering-air static pressure in inches wg.
 - f. Leaving-air static pressure in inches wg.
 - g. Air static-pressure differential in inches wg.
 - h. Low-fire fuel input in Btu/h.
 - i. High-fire fuel input in Btu/h.
 - j. Manifold pressure in psig.
 - k. High-temperature-limit setting in deg F.
 - l. Operating set point in Btu/h.
 - m. Motor voltage at each connection.
 - n. Motor amperage for each phase.
 - o. Heating value of fuel in Btu/h.
- H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
 - 1. Unit Data:

- a. System identification.
 - b. Location.
 - c. Coil identification.
 - d. Capacity in Btu/h.
 - e. Number of stages.
 - f. Connected volts, phase, and hertz.
 - g. Rated amperage.
 - h. Airflow rate in cfm
 - i. Face area in sq. ft.
 - j. Minimum face velocity in fpm.
2. Test Data (Indicated and Actual Values):
- a. Heat output in Btu/h.
 - b. Airflow rate in cfm.
 - c. Air velocity in fpm.
 - d. Entering-air temperature in deg F.
 - e. Leaving-air temperature in deg F.
 - f. Voltage at each connection.
 - g. Amperage for each phase.
- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
- a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Motor Data:
- a. Motor make, and frame type and size.
 - b. Horsepower and speed.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan speed.

- d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System fan and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft.
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- K. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.
- B. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. 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."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.
- E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

- A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter 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 and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
 - 3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
- B. Related Sections:
 - 1. Section 230716 "HVAC Equipment Insulation."
 - 2. Section 233113 "Metal Ducts" for duct liners.

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.
- C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 - 1. Sheet Form Insulation Materials: 12 inches square.
 - 2. Sheet Jacket Materials: 12 inches square.
 - 3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

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 E84, 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.

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.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290 with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation; Saint-Gobain North America.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. CertainTeed Corporation; Saint-Gobain North America.
- b. Johns Manville; a Berkshire Hathaway company.
- c. Knauf Insulation.
- d. Owens Corning.

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. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA.
 - b. Armacell LLC.
 - c. K-Flex USA.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Speedline Corporation.
 - d. The Dow Chemical Company.

2.3 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
 - d. Vimasco Corporation.
 - 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F
 - 4. Color: White.
- C. Vapor-Retarder Mastic: Solvent based; suitable for indoor use on below ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 - 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 3. Service Temperature Range: 0 to 180 deg F
 - 4. Color: White.
- D. Vapor-Retarder Mastic: Solvent based; suitable for outdoor use on below ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 3. Service Temperature Range: Minus 50 to plus 220 deg F
 - 4. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Knauf Insulation.
 - e. Mon-Eco Industries, Inc.
 - f. Vimasco Corporation.
2. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F
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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Vimasco Corporation.
 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
 4. Color: White.

2.5 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Mon-Eco Industries, Inc.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F
 5. Color: Aluminum.

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B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F
5. Color: White.

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 C1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.
 5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, 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 D1784, 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Proto Corporation.
 - d. Speedline Corporation.
 2. Adhesive: As recommended by jacket material manufacturer.

3. Color: White.

D. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross laminated polyethylene film covered with white stucco-embossed aluminum-foil facing.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Polyguard Products, Inc.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.

b. Compac Corporation.

c. Ideal Tape Co., Inc., an American Biltrite Company.

d. Knauf Insulation.

e. Venture Tape.

2. Width: 3 inches.

3. Thickness: 11.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. 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 C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.

b. Compac Corporation.

c. Ideal Tape Co., Inc., an American Biltrite Company.

d. Knauf Insulation.

e. Venture Tape.

2. Width: 3 inches.

3. Thickness: 6.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

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6. Tensile Strength: 40 lbf/inch in width.
 7. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Compac Corporation.
 - b. Ideal Tape Co., Inc., an American Biltrite Company.
 - c. Venture Tape.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 2. Width: 2 inches.
 3. Thickness: 3.7 mils
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch 3/4 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B209 Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch/4 inchwide with wing seal or closed seal.

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B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding 0.106-inch, or 0.135-inch diameter shank, length to suit depth of insulation indicated.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Hardcast; a Carlisle Company.
 - 4) Midwest Fasteners, Inc.
 - 5) Nelson Stud Welding.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch, or 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.
 - 2) CL WARD & Family Inc.
 - 3) Gemco.
 - 4) Hardcast; a Carlisle Company.
 - 5) Midwest Fasteners, Inc.
 - 6) Nelson Stud Welding.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: .062-inch soft-annealed, stainless steel

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. C & F Wire.

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.

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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:

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1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches4 inches 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 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 below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

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4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: 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.
 1. Comply with requirements in Section 078413 "Penetration Firestopping."
- E. Insulation Installation at Floor Penetrations:
 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 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 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 and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches place pins 16 inches o.c. each way, and 3 inches 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 over compress 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 from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch 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 at 18-foot 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.
 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches 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-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board 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, 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 and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches space pins 16 inches o.c. each way, and 3 inches 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 over compress insulation during installation.
 - e. 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 from one edge and one end of insulation segment. Secure

laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch 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 at 18-foot 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
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. 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 overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant

recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 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.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
 - 3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 4. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed rectangular, round and flat-oval, supply-air and return-air duct insulation shall be the following:
 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- B. Concealed rectangular round and flat-oval, exhaust-air duct within 10' of the exhaust termination insulation shall be the following:
 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. Ft nominal density.

END OF SECTION 230713

SECTION 230800 - COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS.

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

1.2 SUMMARY.

- A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

1.3 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 INFORMATIONAL SUBMITTALS.

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

1.5 ALLOWANCES

- A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by the "Schedule of Allowances" Article in Section 012100 "Allowances".

1.6 UNIT PRICES

- A. Commissioning testing allowance may be adjusted up or down by the "List of Unit Prices" Article in Section 012200 "Unit Prices" when actual man-hours are computed at the end of commissioning testing.

1.7 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.
- D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.8 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing, adjusting, and balancing of Work are complete
- D. Provide test data, inspection reports, and certificates in Systems Manual.

1.9 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan.
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
 - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
 - 4. Certificate of readiness, signed by the Contractor, certifying that HVAC&R systems, assemblies, equipment, components, and associated controls are ready for testing.

COMMISSIONING OF HVAC SYSTEMS

5. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
6. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
7. Test and inspection reports and certificates.
8. Corrective action documents.
9. Verification of testing, adjusting, and balancing reports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION.

3.1 TESTING PREPARATION.

- A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TESTING AND BALANCING VERIFICATION.

- A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the Owner's representative.
- B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

- C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.
 - 1. The CxA will notify testing and balancing Subcontractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The testing and balancing Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
 - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS.

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA along with the HVAC&R Contractor, testing and balancing Subcontractor, and HVAC&R Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES.

- A. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Section 230900 "Building Automation System." Assist the CxA with preparation of testing plans.
- B. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
- C. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

END OF SECTION 230800

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

- B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233116 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

- B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of all duct runs from building grid lines.

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6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Welding certificates.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 3. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.

METAL DUCTS

- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible". Seismically brace duct hangers and supports in accordance with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 - 1. Seismic Hazard Level (SHL): Consult Structural Drawings
- C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

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.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. For ducts with longest side less than 36 inches select joint types in accordance with Figure 2-1.
 - 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing

requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate in accordance with 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."
- C. Longitudinal Seams: Select seam types and fabricate in accordance with 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 in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate in accordance with 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. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.

- D. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- G. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches

2.5 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation; Saint-Gobain North America.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
 - 2. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 3. 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.
 - 4. Solvent or Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.
- B. Insulation Pins and Washers:
 - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.

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C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. 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.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm or greater.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. 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:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 4 inches
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
 7. Service: Indoor and outdoor.

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8. Service Temperature: Minus 40 to plus 200 deg F
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

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2.7 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.
- F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

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- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches
- J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- M. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- N. Branch Connections: Use lateral or conical branch connections.

3.2 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.

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6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

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3.5 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. For cleaning of existing ductwork, see Section 230130.52 "Existing HVAC Air Distribution System Cleaning."
- C. Use duct cleaning methodology as indicated in NADCA ACR.
- D. Use service openings for entry and inspection.
 - 1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- E. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

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2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

F. Clean the following components 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, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

G. 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, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.8 STARTUP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

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1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- B. Supply and Return Ducts:
1. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive or Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round and Flat Oval: 4.
- C. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round and Flat Oval: 4.
- D. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.
 2. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 3. Aluminum Ducts: Aluminum.
- E. Liner:
1. Supply-Air Ducts up to 10' from fan/unit outlet: Fibrous glass, Type I, 1 inches thick.
 2. Return-Air Ducts up to 10' from fan/unit inlet: Fibrous glass, Type I, 1 inches thick.
 3. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
 4. Transfer Ducts: Fibrous glass, Type I, 1 inches thick.
- F. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:

- 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14Inches and Larger in Diameter: Welded.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: High Efficiency Takeoff.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

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. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Flange connectors.
4. Turning vanes.
5. Duct-mounted access doors.
6. Duct access panel assemblies.
7. Flexible connectors.
8. Duct accessory hardware.

- B. Related Requirements:

1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.
2. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
3. Section 284621.11 "Addressable Fire-Alarm Systems" for duct-mounted fire and smoke detectors.
4. Section 284621.13 "Conventional Fire-Alarm Systems" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. For duct silencers, include pressure drop, dynamic insertion loss, and self-generated noise data. Include breakout noise calculations for high-transmission-loss casings.

- B. 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. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, or BIM model, 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.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 90A and NFPA 90B.
- 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 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Lloyd Industries, Inc.
 - 3. Nailor Industries Inc.
 - 4. Pottorff.

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- 5. Ruskin Company.
- B. Description: Gravity balanced.
- C. Performance:
 - 1. Maximum Air Velocity: 2000 fpm
 - 2. Maximum System Pressure: 2 inches wg.
 - 3. AMCA Certification: Test and rate in accordance with AMCA 511.
 - 4. Leakage:
 - a. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
- D. Construction:
 - 1. Frame:
 - a. Hat shaped.
 - b. 16-gauge-thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.
 - 2. Blades:
 - a. Multiple single-piece blades.
 - b. Center, Off-center or End pivoted, maximum 6-inchwidth, 16-gauge-thick, with sealed edges.
 - 3. Blade Action: Parallel.
- E. Blade Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.
- F. Blade Axles:
 - 1. Material: Nonferrous metal.
 - 2. Diameter: 0.20 inch.
- G. Tie Bars and Brackets: Aluminum or Galvanized steel.
- H. Return Spring: Adjustable tension.
- I. Bearings: Steel ball or synthetic pivot bushings.
- J. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Chain pulls.
 - 4. Screen Mounting:
 - a. Front mounted in sleeve.

- 1) Sleeve Thickness: 20 gauge minimum.
- 2) Sleeve Length: 6 inches minimum.
5. Screen Material: Aluminum.
6. Screen Type: Bird.
7. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Performance:
 - a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch w/differential static pressure.
2. Construction:
 - a. Linkage out of airstream.
 - b. Suitable for horizontal or vertical airflow applications.
3. Frames:
 - a. Hat-shaped, 16-gauge-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; 16 gauge thick.
5. Blade Axles: Nonferrous metal.
6. Bearings:
 - a. Oil-impregnated bronze or Molded synthetic.
 - b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
7. Tie Bars and Brackets: Galvanized steel.
8. Locking device to hold damper blades in a fixed position without vibration.

B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 FLANGE CONNECTORS

- A. Description: Add-on or roll-formed, factory fabricated, slide-on transverse flange connectors, gaskets, and components.
- B. Material: Galvanized steel.
- C. Gauge and Shape: Match connecting ductwork.

2.5 TURNING VANES

- A. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- D. Vane Construction:
 1. Single wall.

2.6 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."
 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. 24-gauge-thick galvanized steel door panel.

- d. Vision panel.
 - e. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - f. Fabricate doors airtight and suitable for duct pressure class.
- 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - a. 24-gauge-thick galvanized steel or 0.032-inch-thick aluminum <Insert value> frame.
- 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.7 DUCT ACCESS PANEL ASSEMBLIES

- A. Access panels used in cooking applications:
 - 1. Labeled compliant to NFPA 96 for grease duct access doors.
 - 2. Labeled in accordance with UL 1978 by an NRTL.
- B. Panel and Frame: Minimum thickness 16-gauge carbon steel.
- C. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
- D. Gasket: Comply with NFPA 96, grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- E. Minimum Pressure Rating: 10 inches wg positive or negative.

2.8 FLEXIBLE CONNECTORS

- A. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Materials: Flame-retardant or noncombustible fabrics.
- D. Coatings and Adhesives: Comply with UL 181, Class 1.

- E. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Provide metal compatible with connected ducts.
- F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.
- H. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
 - 1. Minimum Weight: 16 oz./sq. yd.
 - 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 deg F.

2.9 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.10 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No. 2 finish for concealed ducts and polished finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.

- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 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 backdraft and control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
- E. Install volume dampers at points on supply, return, and exhaust 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.
- F. Set dampers to fully open position before testing, adjusting, and balancing.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
- H. Connect ducts to duct silencers with flexible duct connectors.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

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6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 7. At each change in direction and at maximum 50-ft.spacing.
 8. Upstream from turning vanes.
 9. Upstream or downstream from duct silencers.
 10. For grease ducts, install at locations and spacing as required by NFPA 96.
 11. Control devices requiring inspection.
 12. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.
- K. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches
 6. Body plus Ladder Access: 25 by 17 inches.
- L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to equipment.
- N. For fans developing static pressures of 5 inches wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Install duct test holes where required for testing and balancing purposes.
- P. 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 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 size and location of access doors are adequate to perform required operation.
 3. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
 4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233346 - FLEXIBLE DUCTS

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. Insulated flexible ducts.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For flexible ducts.
 - 1. Include plans showing locations and mounting and attachment details.

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.

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.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."

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- D. Comply with ASTM E96/E96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 INSULATED FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flexmaster U.S.A., Inc.
 - 2. McGill AirFlow LLC.
 - 3. Thermaflex; a Flex-Tek Group company.
 - 4. Ward Industries; a brand of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, polyethylene fabric mechanically locked to duct helix; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 5.0-inch wg negative (thru 16" diameter).
 - 2. Maximum Air Velocity: 55000 fpm.
 - 3. Temperature Range: Minus 10 to plus 250 deg F
 - 4. Insulation R-Value: R-6

2.3 FLEXIBLE DUCT CONNECTORS

- A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install flexible ducts 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 in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- C. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped in place.
- D. Connect flexible ducts to metal ducts with draw bands.
- E. Install duct test holes where required for testing and balancing purposes.
- F. Installation:
 - 1. Install ducts fully extended.
 - 2. Do not bend ducts across sharp corners.
 - 3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.

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4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

G. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION 233346

SECTION 233423 - HVAC POWER VENTILATORS

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. Ceiling-mounted ventilators.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
 - 2. Rated capacities, operating characteristics, and furnished specialties and accessories.
 - 3. Certified fan performance curves with system operating conditions indicated.
 - 4. Certified fan sound-power ratings.
 - 5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 6. Material thickness and finishes, including color charts.
 - 7. Dampers, including housings, linkages, and operators.
 - 8. Prefabricated roof curbs.
 - 9. Fan speed controllers.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints.
- C. Delegated Design Submittal: For unit hangars and 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. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, or BIM model, drawn to scale, showing the items described in this Section and coordinated with all building trades.
- B. Seismic Qualification Data: For fans, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity, and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Product Certificates: Submit certificates that specified equipment will withstand required wind forces, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force 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. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For HVAC power ventilators to include in normal and emergency operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration isolation, supports, and seismic restraints, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- F. Seismic Performance: HVAC power ventilators shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. See Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Component Importance Factor: 1.0.

2.2 CEILING-MOUNTED VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Broan-NuTone LLC.
 - 2. Greenheck Fan Corporation.
 - 3. Loren Cook Company.
 - 4. PennBarry.
 - 5. S & P USA Ventilation Systems, LLC.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel removable for service.
- D. Back-draft damper: Integral.
- E. Grille: Plastic louvered grille with flange on intake and thumbscrew or spring retainer attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:

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1. Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Motion detector with adjustable shutoff timer.
5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless steel springs, and fusible link.
6. Filter: Washable aluminum to fit between fan and grille.
7. Isolation: Rubber-in-shear vibration isolators.
8. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 SOURCE QUALITY CONTROL

- A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.
- B. AMCA Certification for Fan Aerodynamic Performance Ratings: Test, rate, and label in accordance with AMCA 211.
- C. AMCA Certification for Fan Energy Index (FEI): Test, rate, and label in accordance with AMCA 211.
- D. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install power ventilators level and plumb.
- B. Equipment Mounting:
 1. Secure roof-mounted fans to roof curbs with zinc-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.
 2. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
 3. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

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4. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- C. Install units with clearances for service and maintenance.
- D. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 STARTUP SERVICE:

- A. Perform startup service.
 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 2. Verify that shipping, blocking, and bracing are removed.
 3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

4. Verify that cleaning and adjusting are complete.
5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
6. For belt-drive fans, disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
7. Adjust belt tension.
8. Adjust damper linkages for proper damper operation.
9. Verify lubrication for bearings and other moving parts.
10. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
11. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
12. Shut unit down and reconnect automatic temperature-control operators.
13. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Lubricate bearings.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 CLEANING

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 2. Test and adjust controls and safeties.
 3. Fans and components will be considered defective if they do not pass tests and inspections.
 4. Prepare test and inspection reports.

END OF SECTION 233423

SECTION 233713.13 - AIR DIFFUSERS

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. Rectangular and square ceiling diffusers.
- B. Related Requirements:
 - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
 - 2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.
 - 3. Section 233713.43 "Security Registers and Grilles" for security registers and security grilles.
 - 4. Section 233716 "Fabric Air-Diffusion Devices" for continuous tubular diffusers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples: For each exposed product and for each color and texture specified. Actual size of smallest diffuser indicated.
- C. Samples for Initial Selection: For diffusers with factory-applied color finishes. Actual size of smallest diffuser indicated.
- D. Samples for Verification: For diffusers, in manufacturer's standard sizes to verify color selected. Actual size of smallest diffuser indicated.

1.4 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:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 RECTANGULAR AND SQUARE CEILING DIFFUSERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Krueger-HVAC, a division of Air System Components; Johnson Controls, Inc.
 2. Nailor Industries Inc.
 3. Price Industries.
 4. Titus, a division of Air System Components; Johnson Controls, Inc.
- B. Devices shall be specifically designed for variable-air-volume flows.
- C. Material: Steel.
- D. Finish: Baked enamel, color selected by Architect.
- E. Face Size: 24 by 24 inches
- F. Face Style: Four cone.
- G. Mounting: T-bar.
- H. Pattern: Fixed.
- I. Dampers: Radial opposed blade.
- J. Accessories:
1. Equalizing grid.
 2. Plaster ring.
 3. Safety chain.
 4. Wire guard.
 5. Sectorizing baffles.
 6. Operating rod extension.

AIR DIFFUSERS

2.2 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 233713.23 - REGISTERS AND GRILLES

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. Adjustable blade face registers.

- B. Related Requirements:

- 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
 - 2. Section 233713.13 "Air Diffusers" for various types of air diffusers.
 - 3. Section 233716 "Fabric Air-Diffusion Devices" for continuous tubular diffusers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

- B. Samples: For each exposed product and for each color and texture specified. Smallest size register and grille indicated.

- C. Samples for Initial Selection: For registers and grilles with factory-applied color finishes. Smallest size register and grille indicated.

- D. Samples for Verification: For registers and grilles, in manufacturer's standard sizes to verify color selected. Smallest size register and grille indicated.

1.4 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:

REGISTERS AND GRILLES

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 REGISTERS

A. Adjustable Blade Face Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Krueger-HVAC, a division of Air System Components; Johnson Controls, Inc.
 - b. Nailor Industries Inc.
 - c. Price Industries.
 - d. Titus, a division of Air System Components; Johnson Controls, Inc.
2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal 3/4 inch apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Vertical] spaced 3/4 inch apart.
7. Frame: 1 inch wide.
8. Mounting: Lay in.
9. Damper Type: Adjustable opposed blade.
10. Accessories:
 - a. Front-blade gang operator.
 - b. Filter.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install registers and grilles level and plumb.
- B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 260501 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

- 1.1 Applicable requirements of the Contract Documents, preceding the Technical Specifications, apply to this Section. In the event of conflict between the Specifications, the most stringent shall apply.
- 1.2 Separation of these Specifications into Divisions and Sections is for convenience only and is not intended to establish limits of work.
- 1.3 Consult index to be certain that set of Documents and Specifications is complete. Report omissions or discrepancies to the Owner's Representative.
- 1.4 The Contractor shall employ high standards of good workmanship and shall pay special attention to the safety of personnel and equipment. The installation of material and equipment shall be in conformance with the latest edition of all codes and standards, as adopted by the local authority having jurisdiction, including those listed in Paragraph: STANDARDS. The agency having the most stringent requirements shall be adhered to.
- 1.5 The Contractor shall make a thorough examination of the site and shall make due allowances for difficulties and contingencies to be encountered. All dimensions shall be checked and verified by the Contractor at the site.
- 1.6 The Contractor and all Sub-Contractors shall have a minimum of three years proven experience on projects with similar levels of complexity and magnitude. Experience shall be based on the experience as a company and not on the experience as individuals
- 1.7 The Drawings and Specifications are intended to function as a common set of documents. Anything shown on the Drawings but not mentioned in the Specifications or mentioned in the Specifications and not shown on the Drawings, shall be equally binding as if both noted on the Drawings and called for in the Specifications
- 1.8 OWNER'S REPRESENTATIVE
 - A. The Owner's Representative is the person appointed by the Owner. The Owner's Representative will advise and consult with the Owner during construction and until final payment is due. The Owner's instructions to the Contractor shall be forwarded through the Owner's Representative.

1.9 SCOPE

- A. The work covered by and included in these Specifications consists of the furnishing of all materials, all equipment, labor, tools and supervision and performing all operations necessary for the proper and complete execution of the Electrical work in strict accordance with the Specifications and the Drawings and subject to the terms and conditions of the Contract.
- B. Unless noted otherwise, this Contractor shall furnish and install all control devices together with control wiring, conduit and all appurtenances and accessories necessary to perform the operating functions as specified. Control devices shall include, but not be limited to, thermostats, switching relays, control relays and transformers. Wiring materials and installation shall conform to the National Electric Code. All control system wiring shall be 14 AWG minimum installed in 1/2 inch diameter minimum conduit.
- C. It is the intent of these Drawings and Specifications to provide complete and fully functional systems unless otherwise indicated. The Contractor shall provide all incidental components (locknuts, screws, washers, etc.) required to accomplish this intent. This shall include furnishing devices which are obviously required by the design intent such as the second three-way switch where one such switch is shown, fuses for fused disconnect switches, etc.

1.10 DEFINITIONS

- A. The term "Contractor" or "Electrical Contractor" when used in this Specification refers to the Contractor responsible for all work under this Section.
- B. The term "Provide" refers to this Contractor purchasing, delivering and installing as a part of this Contract.

1.11 STANDARDS

- A. NFPA 70 National Electrical Code (NEC).
- B. NFPA 72 National Fire Alarm Code.
- C. NFPA 99 Standard for Health Care Facilities
- D. NFPA 101 Code for Safety to Life from Fire in Buildings and Structures.
- E. Pennsylvania Act 45, Uniform Construction Code (UCC).
- F. Underwriters Laboratories Electrical Construction Materials Directory.
- G. International Building Code (IBC).
- H. Public Law 101-336, The Americans with Disabilities Act of 1990.

- I. ASTM B-8 Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.
- J. ASTM B-496 Specification for Compact Round Concentric-Lay-Stranded Copper Conductors.
- K. ICEA S-95-658/NEMA WC70 Non-Shielded 0-2 KV Cables.
- L. NETA ATS acceptance testing specifications for electrical power distribution equipment and systems.

1.12 NOTIFICATION

- A. Trades that have work connected with the Electrical work and trades that do preparatory work for electrical equipment shall be notified for installation requirements and scheduling.
- B. The Owner's Representative shall be informed of the installation schedule to allow sufficient time for inspection without any work delay.
- C. All work shall be coordinated to avoid cutting of work in place and interfering with other operations.
- D. In compliance with Act 38, contact individual companies to have utility locations marked in the field and to otherwise locate underground objects as may be necessary prior to the start of construction.
 - 1. Pennsylvania law requires three working days notice for the construction phase and ten working days in design stage. Call Pennsylvania One Call System, Inc. (1-800-242-1776, as of this writing).

1.13 CONTRACT DRAWINGS

- A. The Contract Drawings are diagrammatic and indicate relation of conduits, connections and equipment. Vendor catalog numbers do not necessarily indicate trim and fitting requirements. Drawings do not indicate all boxes and fittings that may be required. Therefore, the Contractor shall carefully investigate structural and finish conditions affecting work. The Contractor shall furnish all boxes, fittings, hangers and accessories as may be required to meet these conditions at no additional cost to the Owner.
- B. Do not scale the Drawings. The Contractor shall check conditions at the site for dimensions and sizes pertaining to the structure.
- C. Do not deviate from the Drawings without prior written approval.

1.14 LINES, GRADE AND SURVERYYS

- A. All necessary surveys, lines, grades and measurements are the responsibility of the Contractor desiring the information for the proper installation of his work. The Contractor is responsible for the proper installation of the work with respect to other Contractors.
- B. Grades, elevations and locations shown on the Drawings are approximate and the Contractor shall check all such information on the site before proceeding with the work

1.15 WORKMANSHIP

- A. All equipment, conduit, fixtures, etc. shall be installed in a workmanlike manner meeting the accepted standards of the representative industry
- B. All work to be performed shall be done by qualified mechanics. All mechanics in the employ of this Contractor on this project shall be skilled in the phases of the work to which they are used. The mechanic's affiliation with labor organizations shall be acceptable to all trades employed on the project.

1.16 SUBMITTAL PROCEDURES

- A. Transmit each submittal with an Engineer accepted form. Include one copy each for the Owner and the Owner's Representative in addition to copies required by the Contractor.
- B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphabetic suffix.
- C. Identify Project, Contractor, Sub-Contractor or Supplier; pertinent drawing sheet and detail number and specification section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction work and coordination of information is in accordance with the requirements of the work and Contract Documents.
- E. Incomplete submittals shall not relieve the Contractor of providing a complete and functional system.
- F. Schedule submittals to expedite the Project. Coordinate submission of related items.
- G. Submittals by the Contractor must be in complete compliance with the Contract Documents unless exceptions are identified. Exceptions to the Contract Documents may only be made to improve the project. Exceptions cannot be taken which would provide an incomplete and/or nonfunctional system.

- H. Exceptions must be included in/on the submittal in a separate paragraph or drawing block located below the Contractor's stamp identified by the title "Exception to Contract Documents." Exceptions cannot be part of the standard Contractor's stamp.
- I. Provide space for Contractor and Owner's Representative review stamps.
- J. The Engineer will return shop drawings with the following designations:
 - 1. Approved: Further submission not required.
 - 2. Approved as Noted: Corrections must be incorporated in final installation. Further submission not required unless specifically noted.
 - 3. Not Reviewed: Placed in project files for information only.
 - 4. Revise and Resubmit: Make necessary changes and resubmit prior to fabrication or purchase.
 - 5. Not Approved: Does not meet project requirements. Resubmit in accordance with Contract Documents.
- K. Revise and resubmit submittals as required, identify all changes made since previous submittal.
- L. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.17 SHOP DRAWING/PRODUCT DATA

- A. Submit shop drawings and/or catalog cuts for all specified materials and equipment
- B. Submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal.
- C. Mark dimensions and values in units to match those specified.
- D. Show equipment sizes and dimensions.
- E. Include wiring diagrams, hole location and sizes, and other data that could affect work by other trades.
- F. Show manufacturer's names, trade names, catalog numbers, accessories, special features and rating data
- G. Indicate required clearances for operating parts, for removal and for servicing
- H. Show all applicable performance data.
- I. Show sound power levels of all rotating equipment.

1.18 SUBSTITUTIONS

- A. Any bidder wishing to substitute "or equal" equipment may request a substitution. Manufacturer's which are submitted as substitutions for approved equal status are considered to have equipment of similar quality, however, the Contractor shall not assume that a piece of equipment by a manufacturer submitted as a "substitution" will be automatically accepted. Compliance with the Drawings and Specifications is still required. If the substituted material is considered to be unacceptable, the Contractor shall provide the equipment as originally specified.
- B. Substitutions are encouraged when there is significant cost savings or improvement to the project. Submit reasons for changes with any requests for substitution. All requests for substitutions must be made within 30 days of contract award unless stated otherwise in the General Conditions.
- C. Bid alternates shall be clearly defined in order to be evaluated during the bidding process
- D. By submitting an alternate or substitution, the Contractor automatically agrees to the following.
- E. The Owner shall be reimbursed by the Contractor for any additional costs incurred by the Owner's Representative to review the substituted materials, in accordance with the then current Owner's Representative's hourly rate.
- F. The Owner shall be reimbursed by the Contractor for any additional costs incurred by the Owner's Representative field or office conferences caused by the substituted materials in accordance with the then current Owner's Representative's hourly rate.
- G. The consideration of alternates/substitutions does not obligate the Owner's Representative to accept same
- H. In the event a brand is approved and substituted, it is the responsibility of the Contractor to so coordinate his substituted material into the original work at no extra cost to the Owner or any other Contractor.

1.19 CUTTING AND PATCHING

- A. In new construction, the Contractor shall give the General Contractor complete information as to size of openings required in floors and walls, etc., so that such openings may be provided as the project progresses. In existing construction, the Contractor shall do his own cutting and patching required for the installation of his work.
- B. If openings are omitted or are incorrect through failure of the Contractor to follow these instructions, the Contractor shall, at his own expense, engage the trade, which originally installed the work, to cut and patch to the satisfaction of the Owner's Representative
- C. All cutting and patching of every nature required in connection with this Contract shall be done by the Contractor with mechanics experienced in their respective lines of work. All patching shall match adjacent finishes

- D. All cutting in building shall be done with great care so as not to leave an unsightly surface, which may not be concealed by plates, escutcheons, or other normal concealing construction. If such unsightly conditions occur the Contractor shall be required at his own expense, to engage the General Contractor to replace the damaged materials with new materials
- E. Any penetrations of a roof shall be done in accordance with the roof manufacturer's recommended details for that type of roof and per industry recognized good practices. The penetration methods shall not invalidate any existing warranties.

1.20 CONCRETE AND MASONARY WORK.

- A. Unless otherwise noted, all concrete bases, reinforcing, etc. and masonry work required to install the respective Contract Work shall be furnished and installed by the respective Contractor.
- B. Provide a 3-1/2 inch high housekeeping pad for all substations, switchboards, motor control centers, transformers, power converters, and other floor mounted equipment. Pads shall extend one inch in all directions beyond the edge of the equipment.
- C. The Contractor shall furnish all materials, labor, equipment and tools necessary to complete concrete and cement work.
- D. All concrete work shall comply with the requirements of the ACI Building Code (ACI 318), the ACI Detailing Manual (ACI 315) and the Specifications for Structural Concrete for Buildings (ACI 301).
- E. All reinforcing steel shall be manufactured from high strength billet steel conforming to ASTM Designation A-615 Grade 60. Welded-wire fabric shall comply with ASTM A-185

1.21 MATERIALS

- A. All materials and equipment provided by this Contractor shall be new, without imperfections and blemishes and shall be protected from the elements prior to installation in building
- B. All equipment shall meet the requirements of NFPA 70 and, in addition, shall be tested, listed and labeled by an approved authority (UL) and shall be installed in accordance with its listing. The Owner's Representative shall have full authority to reject any equipment, material or installation of same, showing defects of manufacture or workmanship.
- C. All equipment subject to specific requirements of the Owner's insurance company (fire alarm system, security system, etc.) shall meet the insurance company's requirements.

1.22 METHOD

- A. The Electrical Contractor shall confer with all other Contractors and shall apply for detailed and specific information regarding the location of all equipment as the final location may differ from

that indicated on the Drawings. Outlets, equipment or wiring improperly placed because of the Electrical Contractor's failure to obtain this information shall be relocated and reinstalled by the Electrical Contractor without additional expense to the Owner

- B. Each Contractor, upon request of the Owner's Representative, shall expedite the work of a specific area, section or part of the project to permit the installation of another part of the work.
- C. All conduits, wire, cable, wiring devices and equipment shall be installed in such a manner as to preserve access with sufficient space provided for proper operation and maintenance to any existing equipment or to any new equipment installed under this Specification or under other Specifications or Contracts for this building
- D. This Contractor shall coordinate his work with that of other trades so that all work may be installed in the most direct manner and so that interference between piping, ducts, equipment, architectural or structural features will be avoided. If an interference results, the Owner's Representative shall decide which work is to be relocated, regardless of which was first installed. Such relocation shall be at no additional cost to the Owner.
- E. All materials and equipment installed by the Contractor shall be firmly supported and secured to the building construction where required.
- F. All items of labor, material and equipment not specified in detail or shown on the Drawings but incidental to, or necessary for, the complete and proper installation and proper operation of the work described herein or reasonably implied in connection therewith, shall be furnished as if called for in detail by the Specifications or Drawings.
- G. All equipment shall be installed in accordance with the manufacturer's recommendations and installation instructions. The manufacturer's installation recommendations and instructions shall be considered part of the Contract.
- H. The equipment installation shall also adhere to the installation recommendations and instructions of other building components such as wall and roof materials which the installation impacts.
- I. Any questions regarding means or methods of construction shall be addressed during the bidding phase of the project.

1.23 SCHEDULING OF WORK

- A. The Contractor shall attend all planning meetings, provide scheduling information and work with all trades to obtain a workable project schedule that meets the Owner's requirements.

1.24 PROTECTION

- A. Each Contractor shall effectively protect his work and materials with tarpaulins or heavy plastic material against dirt, water, chemicals, plaster, or damage during the entire period of installation or until he is directed to remove the coverings by the Owner's Representative. Any damaged

material must be removed and replaced by the Contractor without additional cost regardless of the cause of the damage. All openings in conduit, fittings, etc., must be effectively sealed to exclude dirt, sand and other foreign substances.

1.25 PROTECTION OF OWNER'S EQUIPMENT

- A. The Contractor shall provide any temporary work required to protect the Owner's equipment and to contain the dust generated during construction. Any measures taken by the Contractor for the protection of equipment shall be installed to the satisfaction of the Owner or Owner's Representative, which may include any and all provisions listed in DIVISION-1 General Requirements and/or in accordance with the appropriate technical specifications for wood and plastics in DIVISION-6. An approved protection material is nylon reinforced flame retardant and anti-static Griffolyn T-55 ASFR 6 mil film (1-800-231-6074 - as of this writing).

1.26 RUBBISH REMOVAL AND CLEAN UP

- A. Each Contractor is responsible for periodic removal of all rubbish resulting from his work. All surplus material, refuse, rubbish, etc., shall be removed from the job site at the completion of the Contract. The Owner's Representative must be satisfied with the removal and clean up.
- B. All rubbish shall be legally disposed of by the Contractor. Rubbish removed from the site shall become the responsibility of the Contractor.
- C. Any hazardous materials discovered which are not included in the contract shall be brought to the Owner's attention prior to removal from the site.

1.27 DELIVERING AND STORAGE OF MATERIALS EQUIPMENT

- A. Deliver accessories, small unmarked parts, adhesives, sealants and incidental items to site in manufacturer's original, unopened, labeled containers
- B. Store materials and equipment to prevent damage and injury. Store ferrous materials to prevent rusting. Store equipment and lighting fixtures to prevent staining and discoloring.

1.28 AS-BUILT DRAWINGS

- A. During construction, the Contractor shall maintain a record set of "red-lined" installation prints. He shall record on these prints, all deviations from the Contract Drawings in conduit and electrical conductor sizing, equipment sizing, location and details
- B. At the completion of the work, the Contractor shall transfer this information neatly onto sepias and forward these sepias and the as-built prints to the Owner's Representative.

- C. At the completion of the work, the Contractor shall transfer this information onto one set of prints and onto computer generated construction documents and forward the as-built prints and an electronic copy to the Owner's Representative. Electronic copies of the most recent drawings without title blocks will be made available to the Contractor in AutoCAD versions 2000 or 2002.

1.29 OPERATION AND MAINTENANCE INSTRUCTION

- A. Prior to completion of this project, the Contractor shall deliver to the Owner's Representative for approval three copies of an Operating and Maintenance Manual consisting of items outlined hereinafter.
- B. The purpose of this manual is to assist the Owner in routine operation, maintenance, servicing, troubleshooting and procurement of replacement parts. All information in the manual shall be as-built and only material pertinent to the project shall be included.
- C. The manual shall include the following:
 - 1. Manuals shall be bound, 8-1/2 x 11 inch text pages and set in three-ring binders with durable covers.
- D. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of project and subject matter of binder when multiple binders are required. All subject matter shall be in typewritten format
- E. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab labeling clearly printed under reinforced laminated plastic tabs.
 - 1. Contents: Prepare a Table of Contents for each volume with product or system description identified, type on white paper
 - 2. Part 1: Directory, listing names, addresses and telephone numbers of Owner's Representative, Contractor, Sub-Contractors and major equipment suppliers.
 - 3. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses and telephone numbers of Sub-Contractors and suppliers. Operating and start-up instructions shall be written in a concise step-by-step manner. Maintenance instructions shall include maintenance schedules, procedures, adjustments and trouble-shooting techniques. Identify the following:
 - a. List of equipment.
 - b. Parts list for each component.
 - c. Operating instructions.
 - d. Maintenance instructions for equipment and systems.
 - 4. Part 3: Project documents and certificates, including the following:

- a. Shop drawings and product data.
 - b. Control wiring diagrams.
 - c. Certificates.
 - d. Photocopies of warranties.
 - e. Electrical inspection certificate.
 - f. Copy of panelboard directory.
- 5. Submit one copy of completed volumes in final form 30 days prior to final inspection. This copy will be returned after final inspection, with the Owner's Representative comments. Revise content of documents as required prior to final submittal.
 - 6. Submit final volumes revised, within ten days after the Owner's review.

1.30 IDENTIFICATION OF MATERIALS AND EQUIPMENT

- A. All panels, combination motor starters, safety switches, motor operated time switches, junction and pull boxes, in-panel sub-feeders and similar items installed under this project shall be identified by name, function and/or control. Included on nameplates shall be the voltage of the involved circuits. Nameplates shall be at least one by three inch with characters not less than 1/4 inch high. They shall be made up of two laminated black plastic sheets bonded with a middle sheet of white plastic and characters engraved in one black sheet to the depth of the white plastic.
- B. The Contractor shall provide a typewritten indexed directory in each panelboard indicating the item or items controlled by each circuit.
- C. Directories in any existing panelboards shall be updated in typewritten format showing all circuit changes.
- D. All circuits shall be identified in outlet boxes as to the specific circuit connection. All circuit conductors shall also be identified as to the voltage of the circuit.
- E. Color coding shall be as listed in Section "WIRING" of these Specifications
- F. A typewritten list of nameplates shall be submitted to the Owner's Representative for approval before ordering.

1.31 PAINTING

- A. Where factory finishes are provided and no additional field painting is specified; all marred or damaged surfaces shall be touched up or refinished to a smooth and uniform finish. Provide one-pint quantity of factory finish touch-up paint to the Owner.
- B. All exposed ferrous metalwork, pipe, supports, hangers, insulation and other surfaces not factory painted shall be painted with one prime and two finish coats. Paint, surface preparation and application shall be as specified in the Architectural Section: PAINTING. Colors shall match existing work or shall be as selected by the Owner's Representative.

- C. A quantity of touch-up paint (minimum size - one pint) shall be provided for each color used by the Contractor. Touch-up paint shall be delivered to the Owner.

1.32 LAWS, ORDINANCES, AND REGULATIONS

- A. All systems in all and/or part shall conform to all pertinent laws, ordinances, and regulations of ALL bodies having jurisdiction, at all governing levels. In case of conflict between governing levels, the more stringent law shall apply. As a minimum, all work shall comply with IBC, NFPA, OSHA and USBC requirements.
- B. The Contractor shall pay all fees and prepare and submit all utility applications and obtain and pay for all permits, inspections, and certifications required with his work.
- C. All electrical work shall be inspected and certified by the local authorities; if no local authority inspection is available an independent inspection agency such as the Middle Department Inspection Agency (MDIA) shall be hired by the Contractor.
- D. The Contractor shall make the Owner's Representative aware of any and all code variances that may apply to the electrical equipment/systems. Application for said variances shall be the responsibility of the Owner's Representative.

1.33 BUILDING EXPANSION JOINTS AND FIRE RATED ASSEMBLIES

- A. Provide expansion joints in conduits where they cross building expansion joints
- B. Where cables or conduits pass through fire rated portion of the structure, the annular space between them and the structure shall be filled with an approved fireproof material
- C. Meet all requirements of Underwriter's Laboratories and all applicable codes for maintaining the integrity of all fire rated assemblies.
- D. Contractor shall engage the services of a fire protection contractor to review the drawings and install fire protection products to maintain the integrity of all pipe, wire, conduit, etc. penetrations through any and all fire rated walls, floors, barriers, and assemblies. Fire stop training and products shall be 3M or approved equal.

1.34 ACCESS DOORS

- A. The Contractor shall provide access panels/access doors for access to dampers, valves, controllers or any other equipment or component requiring access for maintenance, adjustment or service wherever these items are concealed in building walls, partitions or ceilings. Frames shall be anchored in walls, partitions or ceilings and shall be set true to lines of the building and flush with the finished surfaces. Access panels/access doors shall be as specified in the General Construction Sections of the Specifications.

1.35 SOUND PARTITIONS

- A. Contractor shall be responsible to identify all sound partitions indicated on the architectural plans. Contractor shall seal all penetrations through the wall to maintain the sound absorption integrity of the partition.

1.36 CONCRETE INSERTS

- A. The Electrical Contractor shall provide concrete inserts of an approved carbon steel wedge type for all hangers. Where two or more parallel conduits are installed continuous inserts may be used. Where required to distribute the load on the inserts, a piece of reinforcing steel of sufficient length shall be passed through the insert. Each insert shall include a knockout piece. Concrete inserts shall have a minimum safety factor of five.

1.37 FIRE STOPPING

- A. The contractor shall be responsible to provide and install fire-stopping materials and/or systems where his work penetrates fire and/or smoke rated portions of the building and non-fire resistance-rated assemblies. All materials used shall be manufactured such that they are intended to resist the spread of fire and the passage of smoke. This includes but is not limited to rated walls, floors, shafts, ceilings, and non-fire resistance-rated horizontal assemblies. All fire stopping materials used shall have a fire resistance rating equal to or greater than the rated assembly for which they are installed.
- B. For locations where the installed fire stopping material is exposed to normal view, the contractor shall conceal the material with chrome-plated escutcheon plates or other materials that have a flame-spread value of 25 or less and a smoke developed rating of 50 or less, as determined per ASTM E 84. The concealing device shall be approved by the owner's representative prior to installation. Provide shop drawings for each device.
- C. The contractor shall provide components/accessories for each fire-stopping system that are needed to install fill materials and to comply with all system performance requirements as recommended by the fire stopping material manufacturer. Accessories include but are not limited to: mineral wool insulation, ceramic fiber, sealants used to aid in the formation of the fire stopping materials, fire-rated formboard, joint fillers and sealers, collars and steel sleeves.
- D. Fire stopping materials and systems shall include, but are not limited to, the following: fire barrier caulk and sealants, intumescent caulk, intumescent putty, intumescent wrap strips, silicone foams and sealants, fire barrier composite sheets and cast-in-place fire barrier systems.
- E. Fire stopping materials and systems shall be as manufactured by 3M Fire Protection Products, Hilti Corporation, or ProSet Systems Inc.

1.38 ANCHOR BOLTS

- A. The Contractor shall provide and set in place, at the time of pouring of concrete foundations, all necessary anchor bolts as required for the equipment called for in these specifications. Anchor bolts shall be of the hook type, of proper size and length to suit the equipment. Anchor bolts shall be set in pipe sleeves of approximately twice the bolt diameter and one half the embedded length of the bolt. The Contractor shall assume full responsibility for proper coordination and placement of the bolts. Upon completion of equipment installation, pipe sleeves shall be caulked in accordance with Section, "SLEEVES" of these Specifications.

1.39 WARRANTY

- A. The systems specified herein shall be guaranteed to be free from defects in workmanship and material under normal use and service for a period of one year from acceptance by the Owner or Owner's Representative.
- B. If, within the aforementioned warranty period, any of the materials specified herein is proven to be defective in any way, it shall be replaced or repaired at no additional cost to the Owner. The warranty shall include the providing of all labor and materials necessary for repair or replacement of any defective components. The Contractor is responsible for the costs of any services required by equipment suppliers that are not included in the suppliers' warranties.
- C. The Contractor shall, after acceptance of the installation by the Owner or the Owner's Representative, provide any service incidental to the proper performance of the system under the warranties outlined above for the time periods listed above.
- D. The Contractor shall be responsible to ensure that his work does not invalidate either wholly or partially any existing warranties or the warranties of material or work performed by others. The Contractor is responsible for the costs to repair damaged work and to re-establish the warranty.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 260501

SECTION 260507 - TEMPORARY POWER AND COMMUNICATION SYSTEMS.

PART 1 - GENERAL

1.1 SUMMARY.

- A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction:

1.2 SUBMITTALS.

- A. Site Plan: Show temporary construction trailer and/or building facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Electrical contractor shall complete and submit a temporary electrical service meter application (load letter) to the local power utility company indicating requested electrical service size, voltage, and all associated loads. Load letter shall also include service start and completion dates.

1.3 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70, Local Building Code and Local Power utility service requirements.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities:

PART 2 - (Not Used).

PART 3 - EXECUTION.

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION.

- A. Temporary overhead/underground electric power utility service shall be coordinated with local power utility company. Provide all electrical equipment infrastructure, connections and extensions of utility services and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Pay electric power service use charges for electricity used by all entities for construction operations.
 - 1. Provide a temporary commercial AC electrical service rated not less than 400 amps at 277/480V, 3-phase, 4-wire, 60 Hz. For construction equipment and a separate temporary commercial AC electrical service rated not less than 100 amps at 120/208V, 3-phase, 4-wire, 60 Hz. For construction trailer(s).
 - 2. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 3. Install electric power service overhead, unless otherwise indicated.
 - 4. Connect temporary service to Owner's existing power source, as directed by Owner.
- B. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, security, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - 2. Install lighting for Project identification sign.
- C. Telephone Service: Provide temporary telephone service in common-use facilities and/or contractor's construction trailer for use by all construction personnel. Install three T1 telephone line(s) for each field office, whether it is in the contractor's construction trailer or on-site building construction facility.
 - 1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine and computer in each field office
 - b. Provide one telephone line(s) for Owner's use.

2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Architect's office.
 - e. Engineers' office.
 - f. Owner's office.
 - g. Principal subcontractors' field and home offices.
 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- D. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, video surveillance security systems in common-use facilities and site.
1. Provide one high speed DSL or T-1 line in primary field office.
 2. Coordinate with telephone utility company a minimum of four (4) weeks prior to construction start date.

END OF SECTION 260507

SECTION 260510 – ELECTRICAL DEMOLITION

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. Removal of existing electrical equipment, wiring, and conduit throughout the entire facility as indicated on drawings; removal of designated construction; dismantling, cutting and alterations for completion of the work.
2. Disposal of materials.
3. Storage of removed materials
4. Identification of utilities.
5. Salvaged items.
6. Protection of items to remain as indicated on Drawing.
7. Relocate existing equipment to accommodate construction.

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of capped utilities.

1.4 SCHEDULING

- A. Schedule work to coincide with new construction.
- B. Cease operations immediately when structure appears to be in danger and notify the Owner. Do not resume operations until directed.

1.5 COORDINATION

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Shut down periods:
 1. Arrange timing of shut-down periods of in service panels with the Owner. Do not shut down any utility without prior written approval.
 2. Keep shut-down period to minimum or use intermittent period as directed by the Owner.

3. Maintain life-safety systems in full operation in occupied facilities, or provide notice minimum 3 days in advance.

PART 2 - PRODUCTS (Not Used).

PART 3 - EXECUTION.

3.1 EXAMINATION.

- A. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.
- B. Verify termination points for demolished services.

3.2 PREPARATION

- A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Contractor's employees, and existing improvements to remain.

3.3 DEMOLITION

- A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to the Owner or his representative before disturbing existing installation.
- B. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.
- C. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not part of final project.
- D. Install temporary wiring and connections to maintain existing systems in service during construction.
- E. Do not perform work on energized electrical equipment or circuits.
- F. Remove, relocate, and extend existing installations to accommodate new construction.
- G. Repair adjacent construction and finishes damaged during demolition and extension work.
- H. Clean and repair existing equipment to remain or to be reinstalled.
- I. Protect and retain power to existing active equipment remaining.
- J. Cap abandoned empty conduit at both ends.

3.4 SALVAGE ITEMS.

- A. Items of salvageable value may be removed as work progresses. Transport salvaged items from site as they are removed.

3.5 CLEANING

- A. Remove demolished materials as work progresses. Legally dispose.
- B. Keep workplace neat.

END OF SECTION 260510

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Metal-clad cable, Type MC.
3. Armored cable, Type AC.
4. Fire-alarm wire and cable.
5. Connectors and splices.

B. Related Requirements:

1. Section 260501 "Basic Electrical Requirements".

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For each conductor and cable indicating lead content

C. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. All building wiring shall be of copper material. Aluminum shall not be permitted to be used.

2.2 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. American Bare Conductor.
 - 3. Belden Inc.
 - 4. General Cable Technologies Corporation.
 - 5. Southwire Company.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.

2.3 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. Belden Inc.
 - 3. General Cable Technologies Corporation.
 - 4. Southwire Company.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Comply with UL 1569.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
 - 1. Single circuit and multi-circuit with color-coded conductors.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

- E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- F. Ground Conductor: Insulated.
- G. Conductor Insulation:
 - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
 - 2. Type XHHW-2: Comply with UL 44.
- H. Armor: Steel, interlocked.
- I. Jacket: PVC applied over armor.

2.4 ARMORED CABLE, TYPE AC

- A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. Belden Inc.
 - 3. General Cable Technologies Corporation.
 - 4. Southwire Company.
- C. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Comply with UL 4.
 - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
 - 1. Single circuit and multi-circuit with color-coded conductors.
 - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- F. Ground Conductor: Insulated.
- G. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.
- H. Armor: Steel, interlocked.

2.5 FIRE-ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire Company.
 - 2. Belden Inc.
 - 3. General Cable Technologies Corporation.
 - 4. Southwire Company.
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 16 AWG or size as recommended by system manufacturer.
 - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600 V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
 - 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with red identifier stripe, NRTL listed for fire-alarm and cable tray installation, plenum rated.

2.6 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Electrical Products.
 - 2. AFC Cable Systems; a part of Atkore International.
 - 3. Hubbell Power Systems, Inc.
 - 4. Ideal Industries, Inc.
 - 5. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 6. Service Wire Co.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.

2. Type: One hole with standard barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG; copper for feeders No. 4 AWG and larger. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.

D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

E. PV 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-2, single conductors in raceway, Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway, Type XHHW-2, single conductors in raceway, Armored cable.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway, Type XHHW-2, single conductors in raceway, Underground feeder cable, Type UF.

E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC.

F. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC.

- G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC.
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION, GENERAL

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. 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.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

- A. Comply with NFPA 72.
- B. Wiring Method: Install wiring in metal pathway according to Section 270528.29 "Hangers and Supports for Communications Systems."
 - 1. Install plenum cable in environmental airspaces, including plenum ceilings.
 - 2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must be installed in a dedicated pathway system.
 - a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.
 - 3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is permitted.
 - 4. Signaling Line Circuits: Power-limited fire-alarm cables must not be installed in the same cable or pathway as signaling line circuits.

- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.
- F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.
- G. Wiring to Remote Alarm Transmitting Device: 1 inch conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 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-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.
- D. Comply with requirements in Section 283111 "Digital, Addressable Fire-Alarm Systems" for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

- A. 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. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors feeding the following critical equipment and services for compliance with requirements:
 - 3. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
 - 4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

- b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- 5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

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. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:
 - 1. Product Data: For each conductor and cable indicating lead content.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:
 - 1) Grounding arrangements and connections for separately derived systems.
 - b. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B.
 - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - 2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Products Division.
 - 2. Burndy; Hubbell Incorporated, Construction and Energy.
 - 3. Harger Lightning & Grounding.
 - 4. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.

2.3 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 B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.
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: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

D. Lead Content: Less than 300 parts per million.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- J. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- K. Water Pipe Clamps:
1. Mechanical type, two pieces with zinc-plated bolts.

- a. Material: Tin-plated aluminum.
 - b. Listed for direct burial.
- 2. U-bolt type with malleable-iron clamp and copper ground connector.
- L. Lead Content: Less than 300 parts per million.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
 - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
 - 2. Backfill Material: Electrode manufacturer's recommended material.
- C. Ground Plates: 1/4 inch thick, hot-dip galvanized.

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 tinned-copper conductor, No. 1/0 AWG minimum.
 - 1. Bury at least 30 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- D. Isolated Grounding Conductors: Green-colored insulation with more than one continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- E. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

F. 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 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.
- B. Transformer: Install grounding electrode(s) at the transformer location to building steel and the building grounding electrode system. The electrode shall be connected to the equipment grounding conductor and to the frame of the transformer.

3.4 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. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- 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, and Antifrost Heating Cables: 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. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 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. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. Use exothermic welds for all below-grade connections.
 - 3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
 - 1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

- E. 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 bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by 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.
- G. 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.
- H. 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 60 feet apart.
- I. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer 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.
4. 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.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 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: 1 ohm.
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

F. 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. Section Includes:

1. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
 1. Hangers. Include product data for components.
 2. Slotted support systems.
 3. Equipment supports.
 4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For hangers and supports for electrical systems.
 1. Include design calculations and details of hangers.
 2. Include design calculations for seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.
- B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.
- B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event"
 - 2. Component Importance Factor: 1.5.
- C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame Rating: Class 1.
 - 2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Allied Tube & Conduit; Atkore International.
 - c. B-line; Eaton, Electrical Sector.
 - d. Flex-Strut Inc.
 - e. G-Strut.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - 4. Channel Width: Selected for applicable load criteria.
 - 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. 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.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored 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 made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti, Inc.
 - 2) MKT Fastening, LLC.
 - 3) Simpson Strong-Tie Co., Inc.

2. 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 where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) B-line; Eaton, Electrical Sector.
 - 2) Hilti, Inc.
 - 3) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 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 Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 1. NECA 1.
 2. NECA 101
 3. NECA 102.
 4. NECA 105.
 5. NECA 111.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- F. 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.

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, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use 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. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Termination boxes.
3. Metal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product:

B. Sustainable Design Submittals:

1. Product Data: For solvents and adhesives, indicating VOC content.
2. Laboratory Test Reports: For solvents and adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer

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RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
 - 2. Anamet Electrical, Inc.
 - 3. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 4. Republic Conduit.
 - 5. Southwire Company.
 - 6. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. FMC: Comply with UL 1; zinc-coated steel or aluminum
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Legrand, a Wiremold company.
 - 2. B-line, an Eaton business.
 - 3. Hoffman; a brand of Pentair Equipment Protection.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70:
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Crouse-Hinds, an Eaton business.
 - 2. Hoffman; a brand of Pentair Equipment Protection
 - 3. Hubbell Incorporated.
 - 4. Hubbell Incorporated; Wiring Device-Kellems.
 - 5. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 6. RACO; Hubbell.
 - 7. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A:
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Metal Floor Boxes:
 - 1. Material: Cast metal or sheet metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

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RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

- G. Nonmetallic Floor Boxes: Nonadjustable, rectangular:
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- I. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- J. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1:
- K. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover:
- L. Box extensions used to accommodate new building finishes shall be of same material as recessed box:
- M. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- N. Gangable boxes are allowed.
- O. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R 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.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- P. Cabinets:
 - 1. NEMA 250, Type 1 or Type 3R 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.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC, IMC, or RNC, Type EPC-40-PVC.
 2. Concealed Conduit, Aboveground: GRC, IMC, EMT.
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried concrete encased.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT:
 3. Exposed and Subject to Severe Physical Damage: EMT ~~IMC~~. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical mezzanine.
 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: IMC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations
- C. Minimum Raceway Size: 1/2-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. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth
- F. Install surface raceways only where indicated on Drawings.

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- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- 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. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab:
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction:
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. 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. Secure raceways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from ENT to GRC or IMC before rising above floor.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT or RMC for raceways
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure
- 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. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- N. 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. Cap underground raceways designated as spare above grade alongside raceways in use.
- O. Surface Raceways.
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- P. Install raceway sealing fittings at accessible locations according to NFPA 70 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.
- Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- R. Expansion-Joint Fittings:
 - 1. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - 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. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change for PVC conduits.
 - 3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

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4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC in damp or wet locations not subject to severe physical damage.
 - T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
 - U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
 - V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
 - W. Locate boxes so that cover or plate will not span different building finishes
 - X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
 - Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
 - Z. Set metal floor boxes level and flush with finished floor surface.
 - AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling".
- 3.4 FIRESTOPPING
- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.
- 3.5 PROTECTION
- A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Round sleeves.
2. Rectangular sleeves.
3. Sleeve seal systems.
4. Grout.
5. Pourable sealants.
6. Foam sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

A. Wall Sleeves, Steel:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, LLC.
 - b. CCI Piping Systems.
 - c. Flexicraft Industries.
 - d. GPT; an EnPro Industries company.
2. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

B. Wall Sleeves, Cast Iron:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Ductile Iron Pipe.
 - b. Flexicraft Industries.
 - c. McWane Ductile.
2. Description: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

C. Sheet Metal Sleeves, Galvanized Steel, Round:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Benefast.
 - b. Specified Technologies, Inc.
2. Description: Galvanized-steel sheet; thickness not less than 0.0239 inch ; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 RECTANGULAR SLEEVES

A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abesco Fire LLC.
 - b. Specified Technologies, Inc.
 - c. Wiremold; Legrand North America, LLC.
2. Description:
 - a. Material: Galvanized sheet steel.
 - b. Minimum Metal Thickness:
 - 1) For sleeve cross-section rectangle perimeter less than 50 inch and with no side larger than 16 inch (400 mm), thickness must be 0.052 inch.
 - 2) For sleeve cross-section rectangle perimeter not less than 50 inch or with one or more sides larger than 16 inch, thickness must be 0.138 inch.

2.3 SLEEVE SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. BWM Company.
3. Flexicraft Industries.
4. Metraflex Company (The).
5. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

1. Sealing Elements: EPDM Nitrile rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 GROUT

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. W.R. Meadows, Inc.

B. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000 psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.5 FOAM SEALANTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Dow Chemical Company (The).
2. Innovative Chemical Products (Building Solutions Group).

B. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non shrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4 inch annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed or seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inch above finished floor level. Install sleeves during erection of floors.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for wall assemblies.
- C. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- D. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1 inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- E. Underground, Exterior-Wall and Floor Penetrations:
 - 1. Install steel pipe sleeves with integral waterstops. Size sleeves to allow for 1 inch annular clear space between raceway or cable and sleeve for installing sleeve seal system. Install sleeve during construction of floor or wall.
 - 2. Install steel pipe sleeves. Size sleeves to allow for 1 inch annular clear space between raceway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

- A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.
- B. Install conduits and cable with no crossings within the sleeve.
- C. Fill opening around conduits and cables with expanding foam without leaving voids.
- D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.3 INSTALLATION OF SLEEVE SEAL SYSTEMS

- A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION 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. Section Includes:
 - 1. Labels.
 - 2. Bands and tubes.
 - 3. Tapes and stencils.
 - 4. Tags.
 - 5. Signs.
 - 6. Cable ties.
 - 7. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.

- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
 - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 4. Color for Neutral: White (208/120V system) or gray (480/277V system).
 - 5. Color for Equipment Grounds: Green.
 - 6. Colors for Isolated Grounds: Green with two or more yellow stripes.
 - 7. Color for 0-10V dimming: Pink and purple
- C. Raceways and Cables Carrying Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
- D. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.
- E. Warning labels and signs shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
- F. Equipment Identification Labels:
1. Black letters on a white field.

2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 2. Marker for Labels:
 - a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - b. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.

- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch- wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:
 - 1. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 2. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
 - 3. Tape Type I:
 - a. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches.
 - c. Thickness: 4 mils.
 - d. Weight: 18.5 lb/1000 sq. ft.
 - e. Tensile according to ASTM D882: 30 lbf and 2500 psi.
 - 4. Tape Type II:
 - a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, continuous-printed on one side with the inscription of the utility compounded for direct-burial service.

- b. Width: 3 inches.
 - c. Thickness: 12 mils.
 - d. Weight: 36.1 lb/1000 sq. ft.
 - e. Tensile according to ASTM D882: 400 lbf and 11,500 psi.
- 5. Tape Type ID:
 - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches.
 - c. Overall Thickness: 5 mils.
 - d. Foil Core Thickness: 0.35 mil
 - e. Weight: 28 lb/1000 sq. ft.
 - f. Tensile according to ASTM D882: 70 lbf and 4600 psi.
- 6. Tape Type IID:
 - a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches.
 - c. Overall Thickness: 8 mils.
 - d. Foil Core Thickness: 0.35 mil.
 - e. Weight: 34 lb/1000 sq. ft..
 - f. Tensile according to ASTM D882: 300 lbf and 12,500 psi.

2.6 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
- C. Write-on Tags:
 - 1. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
 - 2. Marker for Tags:
 - a. Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.7 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.
 - c. Engraved legend with black letters on white face.
 - d. Self-adhesive.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 ps.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 1. Secure tight to surface of conductor, cable, or raceway.

- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- M. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- P. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

- T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- W. Underground Line Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- X. Metal Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using general-purpose cable ties.
- Y. Nonmetallic Preprinted Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using general-purpose cable ties.
- Z. Write-on Tags:
 - 1. Place in a location with high visibility and accessibility.
 - 2. Secure using general-purpose cable ties.
- AA. Baked-Enamel Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch- high sign; where two lines of text are required, use signs minimum 2 inches high.
- BB. Metal-Backed Butyrate Signs:
 - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

CC. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high sign; where two lines of text are required, use labels 2 inches high.

DD. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch- high, black letters on 20-inch centers.
1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10-foot maximum intervals.
- D. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 60 A and 120 V to Ground: Identify with self-adhesive raceway labels.
1. Locate identification 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.
- E. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
1. "EMERGENCY POWER."
 2. "POWER."
 3. "UPS."
- F. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.
- G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

- H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.
- I. Conductors to Be Extended in the Future: Attach marker tape to conductors.
- J. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- K. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- L. Concealed Raceways and Duct Banks, More Than 600 V, within Buildings: Apply floor marking tape to the following finished surfaces:
 - 1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to raceways concealed within wall.
 - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- M. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- N. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- O. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- P. Arc Flash Warning Labeling: Self-adhesive labels.
- Q. Operating Instruction Signs: Self-adhesive labels.
- R. Emergency Operating Instruction Signs: Laminated acrylic or melamine plastic signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- S. Equipment Identification Labels:

1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Stenciled legend 4 inches high.
3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchgear.
 - e. Switchboards.
 - f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - g. Substations.
 - h. Emergency system boxes and enclosures.
 - i. Motor-control centers.
 - j. Enclosed switches.
 - k. Enclosed circuit breakers.
 - l. Enclosed controllers.
 - m. Variable-speed controllers.
 - n. Push-button stations.
 - o. Power-transfer equipment.
 - p. Contactors.
 - q. Remote-controlled switches, dimmer modules, and control devices.
 - r. Battery-inverter units.
 - s. Battery racks.
 - t. Power-generating units.
 - u. Monitoring and control equipment.
 - v. UPS equipment.

END OF SECTION 260553

SECTION 260813 TESTING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY.

A. Section includes requirements for Electrical Testing including, but not limited to:

1. Testing of electrical components and systems.
 - a. Insulation resistance test.
 - b. Continuity test.
 - c. Voltage test.
 - d. Phase relationship verification.
2. Correction of defective components or systems.
3. Retest of corrected components, systems.

1.2 SUBMITTALS.

A. Test reports: Submit six (6) copies of all test reports to Architect/Engineer of Record (3 copies), General Contractor (1).

1. Type each test report on 8-1/2" x 11" paper. Include:
 - a. Project title and location.
 - b. Test performed.
 - c. Data performed.
 - d. Test equipment used.
 - e. Contractor' name, address, and telephone number.
 - f. Testing firm's name, address, and telephone number.
 - g. Names and titles of persons:
 - 1) Performing the tests.
 - 2) Observing test.
 - h. Statement verifying each test.
 - i. Nameplate data from each motor and equipment item tested.
 - j. Retest results after correction of defective components, systems.
 - k. Dates and time of test.
2. For each copy, assemble all test reports and bind them in a folder. Label each folder, "Electrical Test Reports" and include Project Number, title and location.

PART 2 - PRODUCTS.

2.1 MATERIALS.

- A. Furnish all equipment, manpower and casual labor to perform specified testing.

PART 3 - EXECUTION.

3.1 PREPARATION.

- A. Ensure that all electrical work is completed and ready for testing.
- B. Disconnect all devices or equipment that may be damaged by application of test voltages, voltage or reversed phase sequence or other procedures.

3.2 TESTING

- A. Conduct tests and adjust equipment to verify compliance with specified performance.

3.3 INSULATION RESISTANCE TESTS.

- A. Resistance measured: line-to-ground.
- B. Perform testing on the following items:

| Item tested | Min Acceptance Voltage of Test | Resistance in Megohms |
|-----------------------------------|---------------------------------------|------------------------------|
| No. 2 and Larger Cables (600v) | 1000v | 50 |
| | | |

3.4 CONTINUITY TESTS.

- A. Test branch circuits and control circuits to determine continuity of wiring and connection.

3.5 VOLTAGE TESTS.

- A. Make and record voltage tests and record at the following listed points. Conduct tests under normal load conditions.

1. Terminals of all motors.
2. Terminals of all equipment, ie, UPS, refrigeration-compressors, etc.

3.6 PHASE RELATIONSHIP

- A. Examine connections to equipment for proper phase relationships. Verify proper motor rotation.

3.7 CORRECTION OF DEFECTS

- A. When tests disclose any unsatisfactory workmanship or equipment furnished under this Contract, correct defects and retest. Repeat tests until satisfactory results are obtained.
- B. When any wiring or equipment is damaged by tests, repairs or replace such wiring or equipment. Test repaired items to ensure satisfactory operation.

3.8 CONTRACTOR STARTUP AND REPORTING

- A. Contractor shall prepare and submit a complete set of test reports as outlined in this section.

END OF SECTION 260813

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Photoelectric switches
2. Standalone Daylight-harvesting switching and dimming controls.
3. Indoor occupancy and vacancy sensors.
4. Switchbox-mounted occupancy sensors.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Vacancy sensors.
2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale and coordinated with each other, using input from installers of the items involved:
- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

- B. Software and Firmware Operational Documentation:

1.5 WARRANTY

- A. Refer to Division 01 60 00 Product Requirements specification for warranty registration requirements
- B. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wattstopper / Legrand Cooper Industries, Inc..
 - 2. Hubbell Building Automation, Inc.
 - 3. Leviton Manufacturing Co., Inc.
 - 4. Lutron Electronics Co., Inc.
- B. General Requirements for Sensors:
 - 1. Wall or Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
 - 2. Dual technology.
 - 3. Integrated power pack.
 - 4. Hardwired connection to switch and BAS; and BAS and lighting control system.
 - 5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 6. Operation:
 - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes
 - c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes
 - 7. Sensor Output: Sensor is powered from the power pack.
 - 8. Power: Line voltage.

9. Power Pack: Dry contacts rated for 20-A ballast or LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 10. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 12. Bypass Switch: Override the "on" function in case of sensor failure.
 13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- C. Dual-Technology Type: Wall or Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on- off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
 4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 48 inches above finished floor.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Wattstopper / Legrand Cooper Industries, Inc..
 2. Hubbell Building Automation, Inc.
 3. Leviton Manufacturing Co., Inc.
 4. Lutron Electronics Co., Inc.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, with provisions for connection to BAS using hardwired connection.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA ballast or LED load at 120 V, 1200-VA ballast or LED load at 277 V.

2.3 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Schneider Electric Inc.
 2. Wattstopper / Legrand Cooper Industries, Inc.
 3. General Electric.
 4. Hubbell Building Automation, Inc.
 5. Leviton Manufacturing Co., Inc.
 6. Lutron Electronics Co., Inc.
- B. Description: Electrically operated and electrically held, complying with NEMA ICS 2 and UL 508.
 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.

2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- C. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- D. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- E. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.2 INSTALLATION OF WIRING

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's written instructions.
- C. Size conductors in accordance with lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within **12** months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.6 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

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. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20 A.
 - 2. GFCI receptacles, 125 V, 20 A.
 - 3. Twist-locking receptacles.
 - 4. Pendant cord-connector devices.
 - 5. Toggle switches, 120/277 V, 20 A.
 - 6. Decorator-style devices, 20 A.
 - 7. Wall plates.

1.3 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Service/Power Poles: One for every 10, but no fewer than one.
 - 2. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
 - 3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than one.
 - 4. SPD Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with requirements in this Section.
- F. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.
- G. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Essential Electrical System: Red.
3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

H. Wall Plate Color: For plastic covers, match device color.

I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Leviton Manufacturing Co., Inc.
2. Pass & Seymour; Legrand North America, LLC.
3. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
4. Arrow Hart, Wiring Devices; Eaton, Electrical Sector

2.3 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

B. Isolated-Ground Duplex Receptacles, 125 V, 20 A:

1. Description: Straight blade; equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

C. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

D. Weather-Resistant Duplex Receptacle, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

E. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.4 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498 and UL 943 Class A.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.5 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Receptacles, 120 V, 20 A:

1. Configuration: NEMA WD 6, Configuration L5-20R, or as specified on the drawings.
2. Standards: Comply with UL 498.

B. Twist-Lock, Single Receptacles, 250 V, 20 A:

1. Configuration: NEMA WD 6, Configuration L6-20R, or as specified on the drawings.
2. Standards: Comply with UL 498.

C. Twist-Lock, Single Receptacles, 277 V, 20 A:

1. Configuration: NEMA WD 6, Configuration L7-20R, or as specified on the drawings.
2. Standards: Comply with UL 498.

D. Twist-Lock, Isolated-Ground, Single Receptacles, 125 V, 20 A:

1. Grounding: Equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
2. Configuration: NEMA WD 6, Configuration L5-20R, or as specified on the drawings..
3. Standards: Comply with UL 498.

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector, heavy-duty grade.

B. Configuration: NEMA WD 6, Configurations L5-20P and L5-20R, or as specified on the drawings.

C. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.

D. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

E. Standards: Comply with FS W-C-596.

2.7 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A:

1. Standards: Comply with UL 20 and FS W-S-896.

- B. Antimicrobial, Single-Pole Switches, 120/277 V, 20 A:
1. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 2. Standards: Comply with UL 20 and FS W-S-896.
- C. Two-Pole Switches, 120/277 V, 20 A:
1. Comply with UL 20 and FS W-S-896.
- D. Antimicrobial, Double-Pole Switches, 120/277 V, 20 A:
1. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 2. Standards: Comply with UL 20 and FS W-S-896.
- E. Three-Way Switches, 120/277 V, 20 A:
1. Comply with UL 20 and FS W-S-896.
- F. Antimicrobial, Three-Way Switches, 120/277 V, 20 A:
1. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 2. Standards: Comply with UL 20 and FS W-S-896.
- G. Four-Way Switches, 120/277 V, 20 A:
1. Standards: Comply with UL 20 and FS W-S-896.
- H. Pilot-Light, Single-Pole Switches: 120/277 V, 20 A:
1. Description: Illuminated when switch is on.
 2. Standards: Comply with UL 20 and FS W-S-896.
- I. Lighted Single-Pole Switches, 120/277 V, 20 A:
1. Description: Handle illuminated when switch is on.
 2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
- J. Key-Operated, Single-Pole Switches, 120/277 V, 20 A:
1. Description: Factory-supplied key in lieu of switch handle.
 2. Standards: Comply with UL 20 and FS W-S-896.
- K. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A:
1. Description: For use with mechanically held lighting contactors.
 2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

- L. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A:

1. Description: For use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.8 DECORATOR-STYLE DEVICES, 20 A

- A. Decorator Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.

- B. Decorator Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

- C. Decorator, Tamper- and Weather-Resistant, Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

- D. Decorator Single-Pole Switches, 120/277 V, 20 A:

1. Comply with UL 20.

- E. Decorator Single-Pole Lighted Switches, 120/277 V, 20 A:

1. Description: Square face illuminated when circuit is switched off.
2. Standards: Comply with UL 20.

- F. Decorator, Antimicrobial, Single-Pole Switches, 120/277 V, 20 A:

1. Description: Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
2. Standards: Comply with UL 20 and FS W-S-896.

2.9 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.
- D. Antimicrobial Cover Plates:
 - 1. Contact surfaces treated with a coating that kills 99.9 percent of certain common bacteria within two hours when regularly and properly cleaned.
 - 2. Tarnish resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. 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 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.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right 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 comply with 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. Pigtailling existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that 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 (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by 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.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. 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.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

H. 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, multi-gang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Feed through GFCI receptacles are not permitted. GFCI receptacles shall not be daisy chained with non-GFCI receptacles where each location requires or is noted on the drawings with GFCI protection.
- B. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
- C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

3.4 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. In healthcare facilities, prepare reports that comply with NFPA 99.
 - 2. Test Instruments: Use instruments that comply with UL 1436.
 - 3. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- D. Tests for 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 unacceptable.
 - 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. 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.
- E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 265100 - INTERIOR LIGHTING

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. Interior luminaires, lamps, ballasts, LED modules, internal 90-minute emergency batteries and drivers, and related accessories.
 - 2. Luminaire support.
 - 3. Emergency lighting units.
 - 4. Illuminated exit signs.

- B. Related Requirements:

- 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

- A. Average Rated Lamp Life: The period of time after which 50 percent will have failed and 50 percent will have survived under normal conditions.
- B. CCT: Correlated color temperature.
- C. CRI: Color Rendering Index.
- D. Emergency Lighting Unit: A fixture with integral emergency battery power supply and the means for controlling and charging the battery. They are also known as emergency light set. Emergency lighting units available with and without integral heads.
- E. Fixture: See "Luminaire."
- F. IES (IESNA): Illuminating Engineering Society of North America.
- G. IP: International Protection or Ingress Protection Rating.
- H. LED: Light-emitting diode.

- I. Lumen: Measured output of lamp and luminaire, or both.
- J. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 SYSTEM DESCRIPTION

- A. The interior lighting system shall include all lighting fixtures, lamps or LED modules, switches, mounting, wiring, control equipment, and accessories required for complete system, whether or not they are indicated or specified, as indicated in the Drawings and as specified.
- B. The lighting fixture schedules in the Drawings indicate manufacturer, fixture design, appearance and performance desired.
- C. Verify locations of light fixtures indicated in Drawings and coordinate with other reference data and materials as required prior to installation to ensure locations will not interfere with other work. Verify space above luminaires and confirm non-interference with other equipment, such as ducts, pipes, conduit and cabling, and openings. Alert Architect and Commission Authorized Representative in writing to non- standard modifications required for compliance with the Contract Documents and for installation to coordinate with ceiling system before proceeding with the Work.
- D. Verify dimensions. Where discrepancies are found within the Contract Documents, or additional information is required, immediately contact Architect for clarifications and additional information.
- E. Coordinate installation of lighting system with other trades to prevent delays in the Work and to ensure the lighting fixtures and supports will not be damaged by subsequent construction operations.
- F. Lighting fixtures indicated as “EM” or specified with an emergency ballast/driver shall be provided with a UL approved integral / internal 90-minute emergency battery complete with test station and pilot indicator light. These lighting fixtures shall be controlled with normal lighting fixtures. In the event of a power outage or branch circuit failure, emergency lights shall turn on at 100% brightness via internal battery.
- G. Lighting fixtures indicated as “EM” or specified with an emergency ballast/driver shall be provided with a remote test switch mounted to the underside of ceiling adjacent to fixture unless otherwise specified Owner’s Representative.
- H. Lighting fixtures indicated as “EM” or specified with an emergency ballast/driver shall be rated for a temperate of at least negative thirty degrees Celsius (-30°C) or provided with a heater to ensure battery will not freeze.

1.5 ACTION SUBMITTALS

- A. General: Provide separate submittal product data/shop drawings for each fixture type clearly indicating the fixture type designation used in the Drawings and all pertinent options and

accessories. Do not group similar fixture types together on a single cut sheet. Submittals that do not indicate option data where multiple selections exist will be returned without being reviewed.

B. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
6. Photometric data and adjustment factors based on laboratory tests.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

C. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment and luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:
 - a. Other luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Ceiling-mounted projectors.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each type of luminaire.

E. Product Test Reports: For each type of luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

F. Sample warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.9 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Electrical Components, Devices, and Accessories: Listed and labeled by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Regulatory Requirements:

1. Comply with the local authority having jurisdiction.
2. Comply with EPA and municipal regulations for proper recycling or disposal of existing lamps and ballasts removed from the Site

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect luminaires, lamps, and accessories during transit, delivery, storage, and handling to prevent damage.
- B. Deliver luminaires to the Site factory-assembled and wired to the greatest extent possible and in accordance with approved submittals.
- C. Store luminaires, lamps, and accessories in accordance with manufacturer's instructions in a clean, dry location, protected from weather and away from dust generating construction activities. As required, cover materials with tarpaulin or polyethylene sheeting in a manner that allows air circulation and prevents condensation beneath the covering.
- D. Keep handling on site to a minimum. Exercise particular care to avoid damage to exposed finishes and materials.

1.11 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.
- B. Coordinate installation of lighting fixtures indicated to extend in continuous, wall to wall installation. Provide field, or established, dimensions to luminaire manufacturer in sufficient time so not to cause delays in the Work.
- C. Coordinate installation of lighting fixtures to allow for the recommended "burn-in" periods for the lamps installed.

1.12 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance:
 - 1. Luminaires shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
 - 2. Luminaires and lamps shall be labeled vibration and shock resistant.
 - 3. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."
- B. Ambient Temperature: 5 to 104 deg F .
 - 1. Relative Humidity: Zero to 95 percent.

2.2 MANUFACTURERS

- A. Manufacturers – Luminaires: Subject to compliance with requirements indicated and the design criteria specified in the Fixture Schedule.
 - 1. Hubbell Lighting, Inc.
 - 2. Acuity
 - 3. Cooper Lighting.
- B. Manufacturers – Accessories: Subject to compliance with requirements.

2.3 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:

- a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI.
- C. Recessed luminaires shall comply with NEMA LE 4.
- D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- F. Solid State Lighting Luminaires: Comply with UL 8750.
 - 1. Luminous flux, luminaire efficiency and chromaticity shall be tested, measured and reported in accordance with the most current versions of IES documents LM-79 and LM-80.
 - 2. Chromaticity ranges for "white light" products, with various correlated color temperatures, shall be provided in accordance with ANSI/NEMA-C78.377.
 - 3. Drivers and power supplies shall be provided in accordance with the requirements of ANSI/NEMA-C82.SSL1 and their maximum allowable harmonic emission limits shall be in accordance with ANSI/NEMA-C82.77.
 - 4. Shall be provided with a U.S. Department of Energy (DOE) "Lighting Facts" label indicating their specific performance characteristics, tested and reported in accordance with the requirements of the most current version of IES LM-79.
- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Luminaire Coatings and Finishes:
 - 1. Luminaire surfaces, components, trim, and housing shall be factory pre-treated, rustproof, primed and otherwise prepared to inhibit rust and corrosion. Exposed luminaire surfaces shall be factory pre-treated, primed and finish coated with a suitable rust and corrosion inhibiting product.
 - 2. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - a. White Surfaces: 85 percent.
 - b. Specular Surfaces: 83 percent.
 - c. Diffusing Specular Surfaces: 75 percent.
 - d. Laminated Silver Metallized Film: 90 percent.
 - 3. Luminaries shall receive manufacturer's standard finish, unless otherwise indicated. Color shall be as indicated or, if not indicated, as selected by Architect from manufacturer's standard range.
 - 4. Exposed finish shall be free of streaks, runs, holidays, stains, blisters, and similar defects.

I. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise is indicated.
 - b. UV stabilized.
2. Glass globes, diffusers and lenses shall be fabricated from annealed crystal glass, or tempered glass, unless otherwise indicated.

J. Louvers:

1. Provide louvers or baffles fabricated from aluminum reflector sheet free of marks including mars and indentations caused by fabrication and assembly techniques. No rivets, springs, or other hardware shall be visible after installation. Plastic louvers are not permitted.
2. Provide non-iridescent type louvers for fixtures using fluorescent lamps.
3. Provide louvers and baffles of first-quality polished, buffed, and anodized. Anodized finish shall be Alzak.

K. Reflectors and Trims:

1. Attach non-permanently affixed reflectors to housing by means of safety chains or spring clips, to prevent reflectors from falling. No part of the clip or chain shall be visible after installation, when viewed from any angle up to 45 degrees from horizontal.
2. Aluminum Reflectors:
 - a. Provide reflectors and reflecting cones fabricated from aluminum reflector sheet free of marks including spinning lines, mars, and indentations caused by fabrication and assembly techniques. No rivets, springs, or other hardware shall be visible after installation. Provide only reflectors free from blemishes, scratches, or indentations.
 - b. Provide reflectors of first-quality polished, buffed, and anodized. Anodized finish shall be Alzak.
 - c. Provide non-iridescent type louvers for fixtures using fluorescent lamps.
 - d. Provide polished self-flanged trim cones, color finish shall match that of the cone.
3. Painted Reflectors: Completely formed before application of primer and paint. Minimum of 87 percent reflectance white.

L. Product Description: Provide complete luminaire assemblies with features, options and accessories as scheduled and required for complete assembly, whether specified or not.

M. Provide fixtures constructed, wired, and installed in compliance with appropriate UL standards and applicable codes. Provide fixtures that are listed by UL for the applications and locations where they are shown. Provide all products with UL label.

- N. Verify and provide luminaires that are appropriate for the mounting conditions and space structure.
- O. All fixture components must operate within the temperature limits of their design.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:

1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

2.5 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

2.7 LED DRIVERS

- A. LED drivers shall be factory provided by the respective luminaire manufacturers, and shall be suitable for their intended use, to operate the designated LED modules listed in the Luminaire Schedule, and as specified herein, to their full light output.
- B. Comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR Part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
- C. Provide identical drivers within each luminaire type.
- D. Provide UL listed and labeled drivers. Provide drivers with temperature ratings appropriate to the installation.
- E. Provide complete connection to LED type luminaires through both integrally installed and remote electronic drivers.
- F. Drivers shall be totally enclosed within a metallic enclosure and shall be provided with integral leads color coded per ANSI C82.11, or with poke-in style wire retaining connectors.
- G. Fixtures intended to be dimmed shall have dimming driver compatible with the specified dimmer controls.
- H. Remote Drivers:
 - 1. Remote drivers are specifically not shown on the drawings. Contractor shall install remote drivers in a readily accessible, dry, indoor, concealed location, in accordance with the manufacturer's instructions.
 - 2. Provide ventilated metal enclosures for remote drivers furnished as loose equipment. All wiring to/from remote drivers and their associated LED luminaires shall be installed in conduit.
 - 3. Verify and comply with remote distance limitations specified by the luminaire/driver manufacturer.

2.8 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- 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. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for fluorescent luminaires.

- F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.
- G. Bulb Shape: Complying with ANSI C79.1.
- H. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with driver/ballast.
 - 1. Emergency Connection: Operate two lamp(s) continuously at an output of the rated lumens each lamp upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
 - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet.
 - 4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 5. Battery: Sealed, maintenance-free.
 - 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - 7. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

2.9 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:

1. Operating at nominal voltage to be connected to either 120 or 277 volt systems.
2. Lamps for AC Operation:
 - a. LEDs; 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

C. Self-Luminous Signs:

1. Powered by tritium gas, with universal bracket for flush-ceiling, wall, or end mounting. Signs shall be guaranteed by manufacturer to maintain the minimum brightness requirements in UL 924 for 10 years.
2. Use strontium oxide aluminate compound to store ambient light and release the stored energy when the light is removed. Include universal bracket for flush-ceiling, wall, or end mounting.

2.10 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

1. Emergency Luminaires: As indicated on Fixture Schedule and Drawings, with the following additional features:
 - a. Operating at nominal voltage of 120 or 277 volt.
 - b. Internal emergency power unit.
 - c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.

C. Emergency Lighting Unit:

1. Emergency Lighting Unit: As indicated on Fixture Schedule and Drawings.
2. Operating at nominal voltage of 120 or 277 volt.
3. Wall with universal junction box adaptor.
4. UV stable thermoplastic housing rated for damp locations.
5. Two LED lamp heads.
6. Internal emergency power unit.

D. Remote Emergency Lighting Units:

1. Emergency Lighting Unit: As indicated on Fixture Schedule and Drawings.
2. Operating at nominal voltage of as indicated on Fixture Schedule and Drawings.
3. Wall with universal junction box adaptor.
4. UV stable thermoplastic housing rated for damp or wet locations.
5. Two LED lamp heads.
6. External emergency power unit.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaires:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaires:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaires directly to gypsum board.
- G. Suspended Luminaires:

1. Ceiling Mount:
 - a. Two 5/32-inch-diameter aircraft cable supports adjustable to 10 feet (3 m) in length.
 - b. Hook mount.
 2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
 5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
 2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
- I. Air- Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
- J. Adjust aimable lighting fixtures as required to provide required light intensities.
- K. Adjust aimable heads of emergency lighting units as required to provide required light intensities along egress paths.
- L. Connections:
1. Connect wiring according to Division 26 Section "Conductors and Cables for Electrical Systems."
 2. Grounding lighting units. Tighten electrical connectors and terminals, including grounding connections, according to their manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- M. Lenses, Louvers and Reflectors:
1. Exercise particular care when installing fixtures and lamps in fixtures with specular reflector material to prevent smudging or damaging the reflector surface. Wear clean gloves as recommended by the fixture manufacturer.
 2. Do not install removable reflectors, louvers, diffusers, and decorative elements of lighting fixtures until completion of wet work, plastering, painting and general cleanup in the area of the fixtures, but not more than three days before date scheduled for inspections that establish date of Preliminary Acceptance / Substantial Completion.
 3. Parabolic luminaires shall be installed with protective covers, UL-listed for temporary lighting, over louvers. Upon completion of the Work, remove protective covers with clean gloves as recommended by fixture manufacturer.

- N. Accessibility: Install equipment such as junction and pull boxes, fixture housings, transformers, ballasts, switches and controls, and other apparatus that requires occasional maintenance to be accessible and appropriate for mounting and ceiling conditions.
- O. Install fixtures in mechanical areas after ductwork and piping installation. Locate and mount fixtures as indicated on Drawings unless mechanical equipment prohibits or makes it impractical to do so. In such cases, chain or wall mount fixtures so that serviceable equipment is illuminated.
- P. Locate recessed ceiling luminaires as indicated on Drawings. Mount fixtures at heights and locations indicated. Where heights are not indicated or conflicts exist, coordinate final locations with Architect.
- Q. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation. Replace or repair malfunctioning fixtures and components.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal. Replace or repair malfunctioning fixtures and components. Note and record the following:
 - a. Duration of supply
 - b. Low battery voltage shutdown.
 - c. Normal transfer to battery source and retransfer to normal.
 - d. Low supply voltage transfer.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 260943.16 "Addressable-Luminaire Lighting Controls."

- B. Comply with requirements for startup specified in Section 260943.23 "Relay-Based Lighting Controls."

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

SECTION 270500 – COMMON WORK RESULTS FOR COMMUNICATIONS 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. Provide and install a complete structured cabling, security and background music/overhead paging system support system. The support system shall include, but not be limited to, cabling pathways, grounding and bonding systems and appropriate mounting hardware and accessories. Build out of the telecommunications room and telecommunication enclosure shall be included in the scope of the project. The telecommunication equipment racks will be furnished and installed within the scope of this project. Installation shall include setting or mounting the equipment racks in place, completion of grounding and bonding systems to properly ground and bond all equipment, members and items within the equipment racks and to connect the pre-mounted power strips within the equipment racks to the electrical receptacles. Power strip cables and all ground and bonding conductors shall be properly dressed and supported within the equipment racks and to the appropriate cable pathways. All support systems shall be installed to meet the industry standards of the cabling and connectivity being supported in addition to local and national codes.

1.3 REFERENCED STANDARDS AND CODES

- A. NFPA 70 National Electric Code (NEC).
- B. Authority Having Jurisdiction.
- C. UL® for wiring: UL® Standard 910 “Test method for fire and smoke characteristics of cable used in air handling spaces.” Provide products that are UL® listed and labeled for such use. UL® testing bulletin. Underwriters Laboratories (UL®) cable certification and follow up program.
- D. American National Standards Institute/Telecommunications Industry Association. ANSI/TIA, including associated Addenda:
 - 1. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises.
 - 2. ANSI/TIA-569-C – Telecommunications Pathways and Spaces.
 - 3. ANSI/TIA-606-AB – Administration Standard for Commercial Telecommunications Infrastructure
 - 4. ANSI/TIA-606-A-1 – Administration of Equipment Rooms and Data Center Computer Rooms.

5. ANSI/TIA-607-B – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
 6. ANSI/TIA-607-B-1 – Generic Telecommunications Bonding and grounding (Earthing) for Customer Premises Addendum 1 – External Grounding.
 7. ANSI/TIA-758-B – Customer Owned Outside Plant Telecommunications Infrastructure Standard.
 8. ANSI/TIA-1005-A – Telecommunications Infrastructure Standard for Industrial Premises.
 9. TIA TSB-155-A – Guidelines for the Assessment and Mitigation of Installed Category 6A Cabling to Support 10GBase-T.
 10. TIA TSB-184 – Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling.
 11. TIA-TSB-190 – Guidelines on Shared Pathways and Shared Sheaths.
- E. ANSI/NECA/BICSI 568-2006 – Installing Commercial Building Telecommunications Cabling.
 - F. NECA/BICSI 607-2011 – Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings.
 - G. National Electrical Manufacturers Association (NEMA).
 - H. Institute of Electrical and Electronic Engineers (IEEE).
 - I. American Society for Testing Materials (ASTM).

1.4 RELATED SECTIONS

- A. 260526 – Grounding and Bonding for Electrical Systems.
- B. 20529 – Hangers and Supports for Electrical Systems.
- C. 270526 – Grounding and Bonding for Communications Systems.
- D. 270528 – Pathways for Communications Systems.
- E. 270553 – Identification for Communication Systems .

1.5 DEFINITIONS / ACRONYMS / ABBREVIATIONS

- A. AHJ – Authority Having Jurisdiction.
- B. ANSI – American National Standards Institute.
- C. AWG – American Wire Gauge.
- D. CAT 6 A – Category 6A performance as defined by ANSI/TIA 568-C.2.

- E. EC – Electrical Contractor.
- F. EIA – Electronic Industries Alliance.
- G. ER – Equipment Room.
- H. EOR – Engineer of Record.
- I. GC – General Contractor.
- J. IEC – International Electrotechnical Commission.
- K. ISO – International Organization for Standardization.
- L. MM – Multimode (Fiber Optic Cable).
- M. NECA – National Electrical Contractors Association.
- N. NEMA – National Electrical Manufacturers Association.
- O. OM4 - Optical Multimode 4 “laser optimized” performance as defined by ISO/IEC 11801 Amd2 and ANSI/TIA-568-C.3-1.
- P. OS1 - Optical Singlemode 1 performance as defined by ISO/IEC 11801 and ANSI/TIA-568 C.3.
- Q. OS2 - Optical Singlemode 2 “low water peak” performance as defined by ISO/IEC 11801 Amd2 and ANSI/TIA-568-C.3.
- R. SCS – Structured Cabling System.
- S. SM – Singlemode (Fiber Optic Cable).
- T. STP – Shielded Twisted Pair Cable.
- U. UTP – Unshielded Twisted Pair Cable.
- V. TBB – Telecommunications Bonding Backbone.
- W. TBBIBC – Telecommunications Bonding Backbone Interconnection Bonding Conductor.
- X. TC – Telecommunications Contractor.
- Y. TIA – Telecommunications Industry Association.
- Z. TGB – Telecommunications Ground Bus Bar.
- AA. TGB – Telecommunications Main Ground Bus Bar.

BB. TO – Telecommunications Outlet.

CC. TR – Telecommunications Room.

DD. UNO – Unless Noted Otherwise.

1.6 SUBMITTALS.

A. Product Data:

1. Submit the following in accordance with the general conditions and Division 01 and Division 20 specifications of contract. Submittals to include index with description, specification reference, manufacturer, part number, quantity and page number for manufacturer product specification sheet. Manufacturer's product specifications sheets shall indicate product part number. Where multiple products are indicated, products being submitted shall be clearly indicated on a single specification sheet. Products requiring submittals shall include but not be limited to the following.
 - a. All cable and wire including patch cables and cross-connect wire.
 - b. All connectors and required tools.
 - c. All termination system components for each cable type.
 - d. All equipment room and telecommunications room equipment racks, cabinets, horizontal and vertical cable management, ladder tray, installation hardware and other support equipment.
 - e. All grounding system components.
 - f. All fire seal systems, including manufacturer published installation requirements
 - g. All cable raceways and support hardware

B. Samples.

1. Contractor shall provide samples to the Architect EOR for review and approval. Samples shall be provided for the following:
 - a. Each configuration of work are.
 - b. Termination hardware labeling.
 - c. Backbone labeling scheme.
 - d. Horizontal cabling labeling scheme.

C. Test Plans:

1. Contractor shall provide detailed test plans and test documentation as specified for each sub-system.

D. Shop Drawings:

1. Electrical Contractor shall produce, provide and coordinate shop drawings for all conduits, cable trays and other equipment. All shop drawings are to be coordinated with other trades, architect and EOR.
2. Telecommunications Contractor shall produce, provide and coordinate shop drawings for all ladder racks, equipment cabinets, equipment racks and other equipment. All shop drawings shall be coordinated with other trades, architect and the EOR.
3. All shop drawings are to be produced using AutoCAD version 2004 or later.
4. Cross-connection schedule is to be produced in a matrix / schedule format using the latest version of Microsoft Excel. Include soft copy and hard copies.

E. As-Built Documentation.

1. Contractor shall provide complete as-built documentation. As-built documentation shall include AutoCAD drawings indicating all conduits, cable trays, ladder racks, equipment cabinets, equipment racks and other equipment. All TOs are to be indicated on as-built drawings including TO numbers. Cable paths for all backbone cables are to be indicated on as-built drawings.
2. Contractor shall provide complete as-built documentation. As-built documentation shall include AutoCAD drawings indicating all conduits, cable trays and other equipment.
3. Contractor shall provide 3 hard copies and 1 soft copy on CD.
4. As-built drawings are to be produced using AutoCAD version 2004 or later. The following criteria are to be used:
 - a. Floor/conduit/zone plans are to be produced at a scale of 1/8"=1'0".
 - b. TR and ER partial plans are to be produced at a scale of 1/4" = 1' 0" or 1/2" = 1' 0" as appropriate to the complexity and size of the room in being depicted.
 - c. Alignment targets (targets) are to be included in each file that references a building floor plan.
 - 1) The targets are to present a cross-hair registered to building column line intersections and labeled with the column intersection thus referenced.
 - 2) The targets shall be AutoCAD blocks with the origin at the intersection of the cross-hairs and attributes for the column information.
 - 3) The alignment targets are to reside on a separate layer created for this use.
 - 4) A minimum of two (2) such alignment targets are required for each contiguous area referenced, e.g. if two floors are shown in the same drawing, two alignment targets are required per floor
 - d. Drawing files shall be prepared using English Architectural units
 - e. No custom line-styles are to be used in the preparation of the drawing files.
5. Provide a cross connect schedule for all backbone cables installed. Schedules shall indicate all pairs of the backbone cables and all installed cross connections. Schedules are to be created in latest version Microsoft Excel or another approved format. Include soft copy and hard copies.

F. Test Equipment.

1. TC shall submit manufacturer data sheets for all test equipment to be utilized in the certification of the structured cabling system.
2. The TC shall submit current calibration certificates to EOR for all equipment to be utilized in the testing of the structured cabling system. All calibration certificates are to be issued by the test equipment manufacturer. Certificates are to be received by EOR no less than seven days prior to beginning any testing.

G. Test Data.

1. The contractor shall provide test data as specified for each sub-system.

H. Warranty.

1. Contractor shall provide an extended 5-year warranty covering all work, including but not limited to: equipment, devices and labor.

1.7 CONTRACTOR QUALIFICATIONS

- A. The TC selected for this project shall be certified by the manufacturer(s) of the products specified in this scope of work, adhere to the design engineering, installation and testing procedures and utilize the authorized manufacturer(s) components in completing this project.
- B. The TC shall be experienced in all aspects of the work required to complete this project and shall be required to demonstrate direct experience on recently installed systems of similar size and type.
- C. The TC shall own and maintain equipment and tools required for the installation and testing of Category 6A copper and optical fiber structured cabling systems. The TC shall also employ personnel who are adequately trained in the uses of required tools and equipment.
- D. TC shall submit letters of certification from the proposed system manufacturer indicating the TC is an approved installer of proposed system and has had personnel trained in the proper installation and testing procedures of said system.

1.8 SCOPE OF WORK

A. Telecommunications Scope of Work.

1. The General Contractor (GC) and Telecommunications contractor (TC) shall carefully examine the contract documents and thoroughly become familiar with the building standards and local conditions relating to the work. Failure to do so will not relieve the contractor of the obligations of the contract.
2. Provide UL® listed fireseal systems for all telecommunications cabling pathways using caulk putty, pillows or similar devices per manufacturer's instructions to maintain existing and new fire ratings. Verify rating conditions and locations prior to final bids. All open sleeves, slots or other penetrations shall be fire sealed inside after all cabling is completely installed. Fireseal methods shall be submitted by contractor and shall be subject to the

approval of the owner. Contractor shall provide caps and fireseal to maintain the original cores that are not to be used and/or reused. Contractor shall verify exact quantities in the field prior to submission of bids.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 270500

SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits and fittings.
 - 2. Optical-fiber-cable pathways and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetallic wireways and auxiliary gutters.
 - 5. Metallic surface pathways.
 - 6. Nonmetallic surface pathways.
 - 7. Hooks.
 - 8. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid conduit.
- C. IMC: Intermediate metal conduit.
- D. RTRC: Reinforced thermosetting resin conduit.

1.4 ACTION SUBMITTALS

- A. Product data for the following:
 - 1. Surface pathways
 - 2. Wireways and fittings.
 - 3. Boxes, enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

- C. Samples: For wireways, nonmetallic wireways, surface pathways and tele-power poles and for each color and texture specified, 12 inches long.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of pathway groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
 - 3. Underground ducts, piping, and structures in location of underground enclosures and handholes.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Data: Seismic rating for all pathway racks, enclosures, cabinets, equipment racks, and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Products Division.
 - 2. Allied Tube & Conduit; Atkore International.
 - 3. Alpha Wire.
 - 4. Southwire Company.
- C. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
 2. Comply with TIA-569-D.
- D. GRC: Comply with ANSI C80.1 and UL 6.
- E. ARC: Comply with ANSI C80.5 and UL 6A.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Set screw.
 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch , with overlapping sleeves protecting threaded joints.
- H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal trough of rectangular cross section fabricated to required size and shape, without holes or knockouts, and with hinged or removable covers.
- B. General Requirements for Metal Wireways and Auxiliary Gutters:
1. Comply with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 2. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
 3. Comply with TIA-569-D.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE METAL PATHWAYS

- A. Description: Galvanized steel with snap-on covers, complying with UL 5.
- B. Finish: Manufacturer's standard enamel finish in color selected by Architect. Prime coated, ready for field painting.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.

2.4 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable.
- B. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with TIA-569-D.
- D. Galvanized stainless steel.
- E. [J] [U] shape.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. General Requirements for Boxes, Enclosures, and Cabinets:
 - 1. Comply with TIA-569-D.
 - 2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
 - 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
 - 4. Device Box Dimensions: 4 inches square by 2-1/8 inches deep
 - 5. Gangable boxes are allowed.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- E. Metal Floor Boxes:
 - 1. Material: Cast metal or sheet metal.
 - 2. Type: Semi-adjustable.

3. Shape: Rectangular.
 4. Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized or cast iron with gasketed cover.
- H. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- I. Hinged-Cover Enclosures: Comply with UL 50 and 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. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- J. 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.
 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Indoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT or RNC.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Damp or Wet Locations: GRC.

6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
 7. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: EMT.
 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.
- B. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.
- C. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use set-screw, steel fittings. Comply with NEMA FB 2.10.
- D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- E. Install surface pathways only where indicated on Drawings.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
1. NECA 1.
 2. NECA/BICSI 568.
 3. TIA-569-D.
 4. NECA 101
 5. NECA 102.
 6. NECA 105.
 7. NECA 111.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.
- E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.

- F. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- G. Complete pathway installation before starting conductor installation.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
- J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches of enclosures to which attached.
- L. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- N. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- P. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- S. Install pull wires in empty pathways. 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. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- T. Surface Pathways:
 - 1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
 - 2. Install surface pathway with a minimum 2-inch radius control at bend points.

3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- U. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
 2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway 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.
- V. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, 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 pathway-sealing fittings according to NFPA 70.
- W. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service pathway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- X. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- Y. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - 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. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s)

that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
4. Space hooks no more than 5 feet o.c.
5. Provide a hook at each change in direction.

AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

CC. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

FF. Set metal floor boxes level and flush with finished floor surface.

GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 270528

SECTION 283100 – FIRE DETECTION AND ALARM 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.
- B. **PROTOTYPE NOTE:** Local design team shall confirm if fire pump system is to be provided as required by local authority having jurisdiction.

1.2 SUMMARY

- A. Section Includes:
 - 1. Manual fire-alarm boxes.
 - 2. System smoke detectors.
 - 3. Heat detectors.
 - 4. Notification appliances.
- B. Duct smoke detectors shall be furnished, installed and wired by Division 26. Division 23 Contractor to interface with the fan systems to which they are connected and shall be monitored through the Digital Control System where applicable. Refer to Division 23 Section “Building Automations System (BAS) – Basic Materials Interface Devices and Sensors”. Duct smoke detectors shall be connected to the fire alarm control panel by Division 26. Smoke Detectors shall initiate a supervisory alarm.
 - 1. Electrical contractor shall provide duct smoke detector on the supply header duct with associated remote keyed test station/fan shutdown for HVAC equipment rated 2,000 CFM and greater.
 - 2. Electrical contractor shall provide duct smoke detector on the return header duct with associated remote keyed test station/fan shutdown for HVAC equipment rated 15,000 CFM and greater.
- C. Related Requirements:
 - 1. Section 260519 “LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES” for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.

- B. FACP: Fire Alarm Control Panel.
- C. HLI: Hight Level Interface.
- D. NICET: National Institute of Certification in Engineering Technologies.
- E. PC: Personal computer.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
 - 1. Include construction details, material description, dimensions, profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire alarm system.
 - 1. Comply with recommendations and requirements in the “Documentation” section of the “Fundamentals” chapter in NFPA 72.
 - 2. Include plans, elevations, sections, details, and attachments to other work.
 - 3. Include details of equipment assemblies. Indicated dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 - 4. Detail assembly and support requirements.
 - 5. Include voltage drop calculations for notification-appliance circuits.
 - 6. Include battery-size calculations.
 - 7. Include input/output matrix.
 - 8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
 - 9. Include performance parameters and installation details for each detector.
 - 10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when ai-handling system is operating.
 - 11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
 - 12. Include plans, section, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.
 - c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters’ control system.
 - d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters’ smoke-evacuation system.
 - e. Locate detectors according to manufacturer’s written recommendations.
 - f. Show air-sampling detector pipe routing.

13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliance and smoke and heat detectors, in addition to submittals listed about, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 SAMPLE WARRANTY: For special warranty,

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

- a. Comply with "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completions Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
- c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
- d. Riser diagram.
- e. Device address.
- f. Record copy of site-specific software.
- g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection on installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.
- h. Manufacturer's required maintenance related to system warranty requirements.
- i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective coverings for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Unites: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamper proofed components.
6. Audible and Visual Notification Appliances: One of each type installed,
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

1.10 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm equipment and components that fail in materials or workmanship within specified warranty period.
 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS.

2.1 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All component provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEM OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Duct smoke detectors.
 - 5. Carbon monoxide detectors.
 - 6. Automatic sprinkler system water flow.
 - 7. Fire-extinguishing system operation.
 - 8. Fire standpipe system.
 - 9. Fire pump running.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances, including voice evacuation notices.
 - 2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
 - 3. Transmit and alarm signal to remote alarm receiving station.
 - 4. Unlock electric door locks in designated egress paths.
 - 5. Activate voice/alarm communication system.
 - 6. Switch heating, ventilating, and air conditioning equipment controls to fire-alarm mode.
 - 7. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
 - 8. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - 9. Activate emergency lighting control.
 - 10. Activate emergency shutoffs for gas and fuel supplies.

11. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Fire-pump running.
3. Fire-pump loss of power.
4. Fire-pump power phase reversal.
5. Independent fire-detection and suppression systems.
6. User disabling of zones or individual devices.
7. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit,
7. Break in standby battery circuitry.
8. Failure of batter charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the even at fire-alarm control unit connected network control panels, off-premises network control panels, and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term “withstand” means “the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.”

2.4 MANUAL FIRE ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Key or wrench-operated switch.
 3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Detectors shall be four-wire type.
 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic of combination smoke-and-heat detection units shall be selectable at fire-alarm control unit for 15 or 20 degree F per minute.
 - b. Fixed-temperature sensing characteristics of characteristic of combination smoke-and-heat detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 degree F.
 - c. Multiple levels of detection sensitivity for each sensor.
 - d. Sensitivity levels based on time of day.
- B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at the fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable keyed test station with relay rated to interrupt fan motor-control circuit.
7. Division 26 to provide remote alarm indicator/test switch, which indicates activation of detector.
8. Duct Smoke Detector Test Station.
9. Flush wall mounted except surface wall mounted or group wall mounted or grouped FATC flush door mounted in mechanical equipment rooms.

10. Alarm/power LED.
11. Keyed test switch.
12. Stainless steel faceplate.
13. White lettering on red nameplate identifying associated duct smoke detector.

2.6 CARBON MONOXIDE DETECTORS.

- A. General: Carbon monoxide detector listed for connection to fire-alarm system.
 1. Mounting: Adapter plate for outlet box mounting.
 2. Testable by introducing test carbon monoxide into the sensing cell.
 3. Detector shall provide alarm contacts and trouble contacts.
 4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
 5. Comply with UL 2075.
 6. Locate, mount, and wire according to manufacturer's written instructions.
 7. Provide means for addressable connection to fire-alarm system.
 8. Test button simulates an alarm condition.

2.7 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521
 1. Temperature sensors shall test for and communicate sensitivity range of the device.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

- B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for systems connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- F. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate: The word "FIRE" is engraved in minimum 1-inch high letters on the lens.
 - 1. Rated Light Output:
 - a. 15/30/75/1103 cd selectable in the field.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finished, red.
- G. Voice/Tone Notification Appliances:
 - 1. Comply with UL 1480.
 - 2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems: chapters in NFPA 72.
 - 3. High-Range Units: Rated 2 to 15 W.
 - 4. Low-Range Units: Rated 1 to 2 W.
 - 5. Mounting Flush.
 - 6. Matching Transformers: Tap range matched to acoustical environment of speaker location.
- H. Exit Marking Audible Notification Appliance:
 - 1. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72
 - 2. Provide exit marking audible notification appliances at the entrance to all buildings exits.

3. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

2.9 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 1. Mounting: Flush cabinet, NEMA 25, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

- A. General:
 1. Include address-setting means on the module.
 2. Store an internal identifying code for control panel use to identify the module type.
 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal to circuit-breaker shunt trip for power shutdown.
 1. Allow the control panel to switch the relay contacts on command.
 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
 1. Operate notification devices.
 2. Operate solenoids for use in sprinkler service.

2.11 RADIO ALARM TRANSMITTER

- A. Transmitter shall comply with NFPA 1221 and 47 CFR 90.
- B. Descriptions: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
 3. Normal Power Input: 120-V ac.
 4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
 5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph with a gust factor of 1.3 without failure.
 6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
 7. Antenna Cable Connectors: Weatherproof.
 8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
- C. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:
1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
 2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
 3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
 4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
 5. Local Fire-Alarm System Alarm Message: Actuated when the building system goes into an alarm state. Identifies devices that initiated the alarm.
 6. Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

PART 3 - EXECUTION.

3.1 EXAMINATION.

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
 - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
 - 2. Devices installed but not yet in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Equipment Mounting: Install fire-alarm control unit on finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."
- C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."
- D. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
 - 2. Mount manual fire-alarm box on a background of a contrasting color.
 - 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- E. Smoke or Heat Detector Spacing:

1. Comply with the “Smoke-Sensing Fire Detectors” section in the “Initiating Devices” chapter in NFPA 72, for smoke-detector spacing.
 2. Comply with the “Heat-Sensing Fire Detectors” section in the “Initiating Devices” chapter in NFPA 72, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
 5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- F. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.
1. Do not install smoke detector in duct smoke-detector housing during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- H. Single Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- I. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- J. Audible Alarm-Indicating Devices: Install Not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- K. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- L. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- M. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists 100-mph wind load with a gust factor of 1.3 without damage.

3.3 PATHWAYS

- A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.
1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

- B. Pathways shall be installed in EMT.
- C. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
 - 2. Smoke dampers in air ducts of designated HVAC duct systems.
 - 3. Electronically locked doors and access gates.
 - 4. Alarm-initiating connection to activate emergency lighting control.
 - 5. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 6. Supervisory connections at valve supervisory switches.
 - 7. Data communication circuits for connection to building management systems.
 - 8. Supervisory connections at fire-extinguisher locations.
 - 9. Supervisory connections at fire-pump power failure including dead-phase or phase-reversal condition.
 - 10. Supervisory connections at fire-pump engine control panel.

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUDNING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by Owner, Architect, Engineer and authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 CONTRACTOR START UP AND REPORTING

- A. Field tests shall be witnessed by Owner Representative and authorities having jurisdiction.
- B. Perform tests and inspections:
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72 and as required by the authorities having jurisdiction.

2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72 and as required by the authorities having jurisdiction.
3. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
4. Visual Inspection: Conduct visual inspection prior to testing.
5. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter and as required by the authorities having jurisdiction.
 - a. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
6. Pretesting:
 - a. Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting.
 - b. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications.
 - c. Prepare forms for systematic recording of pretest results.
 - d. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable. The letter shall include the names and titles of the witnesses to the preliminary tests.
7. Final Test Notice: Provide 10 days minimum notice in writing when the system is ready for final acceptance testing.
8. Minimum System Tests: Test the system in accordance with the procedures outlined in NFPA 72 Chapter 10 and as required by the authorities having jurisdiction.
9. Minimum required test are but not limited to the ones listed below:
 - a. Correct deficiencies observed in pretesting.
 - b. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
 - c. Verify the absence of unwanted voltages between circuit conductors and ground.
 - d. Test all conductors for short circuits utilizing an insulation testing device.
 - e. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.
 - f. Verify the control units are in the normal condition as detailed in the manufacturer's operating and maintenance manual.
 - g. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of the initiating and indicating devices. Proper signal transmission in accordance with class of wiring used shall be observed.

- h. Test each initiating and indicating device for alarm operating and proper response at the control unit. Test smoke detectors with actual products of combustion.
 - i. Test the system for all specified functions in accordance with the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each station including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe displays, signal tones, and annunciator indications.
 - j. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.
10. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" as required in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" as required in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 11. Provide all documentation as required by the authorities having jurisdiction.
 12. Reacceptance Testing:
 - a. Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
 - b. Tag all equipment and stations and other components at which tests have been satisfactorily completed. Place tags upon completion of tests.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.11 COMMISSIONING AND DEMONSTRATION

- A. Provide the services of a factory-authorized service representative to demonstrate and train The Owner's maintenance personnel as specified below.
 1. Train the owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Include authorities having jurisdiction requirements. Provide a minimum of 8 hours' training.
 2. Schedule training with the Owner at least seven days in advance.
 3. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls to suit actual occupied conditions. Provide up to three visits to the site for this purpose.
- B. Train Owner's maintenance personnel on procedures and schedules for starting up and shutting down, troubleshooting, servicing, and maintaining the equipment. The training shall occur after the startup report has been provided to the owner and the trainer will provide two (2) Installation and Operations manuals for the use of the owner's personnel during training. Provide a minimum

of two (2) sessions of four (4) hours of training. Provide no more than one training session per day.

1. Training Agenda:

- a. Format shall be an outline broken up into (2) 4 hour sessions.
 - b. The material to be covered shall be sub divided into the description of the material to be covered for each 15 minute intervals.
 - c. The descriptions shall include not only the material to be covered but also its locations in the Installation and Operations manuals, including Section and page number.
- C. Review data in maintenance manuals. Refer to Division 01 Section "Operation and Maintenance Data." All required and recommended maintenance will be reviewed as well as operational trouble shooting. If the IOM does not include a written trouble shooting guide one will be provided.
- D. Demonstrate proper operation of equipment to commissioning agent or designated owner's personnel.

END OF SECTION 283100