

INTERIOR ALTERATIONS
PHASE 3

for the

EASTERN CENTER FOR ARTS AND TECHNOLOGY

WILLOW GROVE, MONTGOMERY COUNTY, PENNSYLVANIA

PROJECT MANUAL

February 1, 2022

BRESLIN ARCHITECTS
ARCHITECTS PLANNERS ALLENTOWN PENNSYLVANIA

SPECIFICATIONS

INTERIOR ALTERATIONS – PHASE 3 WILLOW GROVE, MONTGOMERY COUNTY, PENNSYLVANIA FOR THE EASTERN CENTER FOR ARTS AND TECHNOLOGY

COMMISSION NUMBER 694

February 1, 2022

These Contract Documents have been prepared specifically for this Project and may only be used solely with respect to this Project. The Architect and Engineer retain all common law, statutory, and other reserved rights, including copyright.



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PROJECT SPECIFICATIONS

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**Interior Alterations – Phase 3
Eastern Center for Arts and Technology**

Commission Number 694

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ADVERTISEMENT FOR BIDS

**INTERIOR ALTERATIONS – PHASE 3
for the
EASTERN CENTER FOR ARTS AND TECHNOLOGY
WILLOW GROVE, PENNSYLVANIA**

The Eastern Center for Arts and Technology, Owner, will receive sealed proposals for the Interior Alterations – Phase 3 Project for the Eastern Center for Arts and Technology Building located on 3075 Terwood Road, Willow Grove, Pennsylvania 19090.

Proposals will be received until 3:00 PM prevailing time on Tuesday, March 01, 2022 at the Eastern Center for Arts and Technology Building. Proposals will be publicly opened and read aloud thereafter on the same day.

A Pre-Bid Conference will be held at the project site at 03:00 PM prevailing time on Tuesday, February 15, 2022. Attendance is not mandatory, but is highly recommended. Tours of the site will be available immediately after the pre-bid meeting.

Sealed bids will be received for any and/or all of the following separate Prime Contracts, which includes all work indicated on the Contract Documents:

General Construction
Mechanical Construction
Electrical Construction.

Contract Documents for the work can be obtained by applying to Breslin Ridyard Fadero Architects (hereinafter ‘Architect’), 1226 Union Boulevard, Allentown, PA 18109; telephone 610-437-9626 with a non-refundable fee of \$75.00. Checks shall be made payable to “Breslin Ridyard Fadero Architects”. Documents will be sent electronically via wetransfer.com after receipt of payment. Contractors must supply the following information with their request for documents: Company name, contact person, complete address, phone and fax numbers, and email address.

The Architect is responsible to issue bidding documents and/or addenda only to those bidders who have paid the appropriate deposit amount and obtained bidding documents through the Architect’s office. The Architect is not required to issue bidding documents and/or addenda to subcontractors, suppliers, or bidders who obtain documents through other sources. The Architect is not responsible for completeness of bidding documents and/or addenda obtained through sources other than the Architect’s office.

Proposals must be submitted on forms included in the Bid Documents or on identical forms in a sealed envelope and addressed to the Owner at or before the time above mentioned. Proposals submitted on forms other than as stated will be disregarded. All proposals and their attachments must be submitted in duplicate and include the following:

1. A certified check, bank cashier's check, trust company treasurer's check, or a bid bond on the forms set forth in the contract documents, in an amount not less than ten percent (10%) of the combined base bid, as set forth in Paragraph 10 of the Instructions to Bidders.

ADVERTISEMENT FOR BIDS - 1

2. An Agreement of Surety certifying that a Surety Company is committed to provide the bidder with a Performance Bond and Payment Bond each in the amount of 100% of the combined contract amount, as set forth in paragraph 14 of the Instructions to Bidders.
3. Contractor's Qualification Statement, as set forth in paragraph 15 of the Instructions to Bidders.
4. Non-Collusion Affidavit, as set forth in paragraph 28 of the Instructions to Bidders.

This project is subject to the Pennsylvania Prevailing Wage Act, approved August 15, 1961, P.L. 987 (Act No. 442), as amended and supplemented, and reference is made to the prevailing minimum wage rates applicable to this project which has been promulgated by the Secretary of Labor and Industry.

Bidders shall refer to provisions of the Federal and State statutes, rules and regulations dealing with the prevention of environmental pollution and the preservation of the public natural resources that affect the project; said statement of provisions being submitted, as part of the specifications, pursuant to Section 3301 of the Pennsylvania Commonwealth Procurement Code, 62 Pa.C.S. § 3301.

Bids shall conform to all requirements as more fully set forth in the Bid Documents, including, inter alia, compliance with all applicable laws and regulations.

The Owner reserves the right to reject any or all proposals or any part thereof or items therein and to waive technicalities as it deems best to protect its interest.

Katie Braun
Business Manager
Eastern Center for Arts and Technology

ADVERTISEMENT FOR BIDS - 2

INSTRUCTIONS TO BIDDERS

DEFINITIONS

1.1 Bid Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the Advertisement for Bids, Instructions to Bidders, Bid Form – Proposal, Bid Bond Form, Agreement of Surety, Non-Collusion Affidavit, Contractor’s Qualification Statement, Addendum to Contractor’s Qualification Statement, and other sample bidding and contract forms. The Proposed Contract Documents consists of the Agreement Between Owner and Contractor (hereinafter ‘Agreement’), Performance Bond, Labor and Material Payment Bond, General Conditions of the Contract, Certificate of Insurance, Specifications, Drawings, and all Addenda issued prior to the execution of the Agreement.

1.2 Complete set of PDF Bidding Documents must be used in preparing Bids; neither Owner nor Architect assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents. Bid Documents consist of Contract Documents (and all reference standards), Specifications, Addenda, and Drawings. Bidder is responsible to make sure that the set of Bidding Documents is complete and that any printed Contract Document is legible and represents properly all the information as represented in the bid document PDF file. The latest version of Adobe Reader should be used to view and print the files.

1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Agreement that modify or interpret the Contract Documents by additions, deletions, clarifications or corrections.

1.4 A Bid or Proposal is a complete and properly signed proposal to do the Work (as defined in the General Conditions of the Contract) for the sums stipulated therein, submitted in accordance with the Bid Documents.

1.5 An Alternate Bid is an amount stated in the Bid Form – Proposal to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

1.6 A Bidder is a person or entity that submits a Bid.

BID FORM – PROPOSAL

2. The Bid Form – Proposal, bound in these specifications, is for the information and convenience of bidders and is not to be detached from the Specifications, or filled out or executed. The Architect will supply separate duplicate copies.

2.1 The following information must be completed and submitted with the appropriate Bid Form – Proposal.

- 2.1.1 Executed Bid Bond.
- 2.1.2 Agreement of Surety.
- 2.1.3 Letter of Insurer.
- 2.1.3 Executed Non-Collusion Affidavit.
- 2.1.4 Contractor’s Qualification Statement.
- 2.1.5 Addendum to Contractor’s Qualification Statement.

PREPARATION OF PROPOSAL

3. Bids and all their attachments shall be submitted in DUPLICATE on the Bid Forms included with the Bidding Documents. The blank spaces in the proposal shall state the prices written in ink or typewritten in words and numerals, (numerals only for unit prices), for each and every item for which a description is given. In case of discrepancy, the written words shall be considered as being the bid price. The bidder shall sign his proposal correctly. If the proposal is made by an individual, in addition to his signature, his post office address should be shown; if made by a partnership, the name and post office address of each member of partnership should be shown and be signed by at least one general partner; if made by a corporation, the proposal should be signed by the president or vice president, and secretary or assistant secretary, identify the name, business address and state of incorporation for the corporate, and have the corporation seal affixed.

4. The Bid Form – Proposal shall not be altered. Altered Bid Forms may be considered non-responsive and may be rejected.

5. Bidder shall use complete sets of Bid Documents in preparing Bids; neither Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bid Documents.

6. In making copies of the Bid Documents available, the Owner and Architect do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant permission for any other use of the Bid Documents.

7. All requested alternates as defined in Division 01 or the Bid Documents shall be bid and shall enter a response to all requested Alternates. If no change in the Base Bid is required for an Alternate, enter “No Change.” If the bidder is not providing a bid for an Alternate, enter “No Bid.” If no response is provided, including entering “No Bid,” and the Owner elects to accept that Alternate, the Bidder’s Proposal may be rejected.

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

8. Unit Prices: Provide Unit Prices filled-in on the Bid Form-Proposal in accordance with requirements specified in the proposal/bid form and bidding requirements. Unit costs will be used for adjustment of the Contract Sum if any are required. The Owner reserves the right to reject and Unit Price bid.

9. Allowances: Include all quantity/material allowances listed on the Bid Form-Proposal and project Drawings and Specifications in the Base Bid price. Do not adjust allowances for any Alternates unless specifically listed in the Alternate.

BID SECURITY

10. A proposal for any contract shall be rejected unless accompanied by a Bid Security in the amount not less than ten percent (10%) of the Base Bid. Bid Security shall be in the form of a certified check, bank cashier’s or trust company treasurer’s check, or a bid bond in the form set forth herein, naming as Payee or Obligee, as appropriate, **Eastern Center for Arts and Technology**.

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INSTRUCTIONS TO BIDDERS**

11. The Owner may declare the Bid Security forfeited to the Owner if, following the issuance of a Notice of Intent to Award to the apparent lowest responsible Bidder, such Bidder fails to deliver the items required under paragraph 33 of these Instructions to Bidders within ten (10) days thereafter.

12. If a Bid Bond is used for Bid Security, it shall be submitted in duplicate on the form included in the Bid Documents, and the Attorney-in-Fact who executed the bond on behalf of the surety shall affix to the bond a certified and current copy of its Power of Attorney, authorizing said Attorney-in-Fact to act on behalf of the surety. The Power of Attorney must be dated the same date as the Bid Bond and both the Bid Bond and Power of Attorney shall have affixed the raised corporate seal of the surety. The Bid Bond form must be executed by a surety licensed and authorized to conduct business as a surety within the Commonwealth of Pennsylvania, have an AM Best rating of "A-" or higher and a financial rating of Class X or higher and shall be named in the current list of companies holding Certificates of Authority as accepted sureties on Federal Bonds and as acceptable reinsuring companies as published in Circular 570 (as amended) by the Audit Staff, Bureau of Government Financial Operations, US Treasury Department, and the amount of the bond shall not exceed the underwriting risk of such surety set forth in said Circular or revision thereof.

13. The Bid Security of Bidders will be returned (unless forfeited pursuant to paragraph 8 above) at the Bidder's request, upon (i) the execution of the Agreement Between Owner and Contractor by Owner, or (ii) the rejection of all Bids by Owner or (iii) the expiration of the firm Bid period set forth in paragraph 16 of these Instructions to Bidders. The Owner shall not be liable for any interest on all Bid security that is held in accordance with these instructions to Bidders.

AGREEMENT OF SURETY

14. Each bidder shall submit in duplicate an Agreement of Surety certifying that the Surety will provide the bidder with a Performance Bond and Labor and Material Payment Bond each in the amount of one hundred percent (100%) of the contract amount. The Agreement of Surety shall be in the form included in the Bid Documents. The Agreement of Surety shall be executed by a surety satisfying the requirements set forth in paragraph 12 above and shall be accompanied by the necessary Power of Attorney as noted in paragraph 12 above.

CONTRACTOR'S QUALIFICATION STATEMENT

15. Each bidder shall submit a Qualification Statement in duplicate with his proposal on forms furnished by the Architect (A.I.A. document A305, 2020 Edition) and sworn to before a notary public. Forms shall be completed with current information as of the date of receipt of bids. The Contractor's Qualification Statement shall have attached the Contractor's recently completed calendar or fiscal year financial statement with audit attached. The financial statement shall be dated no earlier than 12 months prior to the date of receipt of bids.

ADDENDA

16. During the bidding period, bidders may be furnished addenda, modifying or interpreting the Bid Documents by additions, deletions, clarifications or corrections, if any, which shall be included in the work covered by the proposal and become a part of the contract documents. The bidder shall acknowledge in his proposal, in the space provided, the addenda that he has

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received, identifying the addenda by their numbers and dates. Addenda will be issued electronically via wetransfer.com.

17. If any prospective bidder on the proposed contract finds discrepancies or omissions or is in doubt as to the true meaning of any part of the plans, specifications or other proposed contract documents, he should at once submit to the Architect a written request for an interpretation thereof. The bidder submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by an addendum duly issued via wetransfer.com to each prospective bidder who has received a set of such documents. Owner shall not be required to respond to any request for interpretations received within three (3) days of Bid date.

18. All interpretations, additions, alterations, corrections and changes to the Bid Documents will be made by addenda. Interpretations, additions, alterations, corrections and changes of the Bid Documents made in any other manner shall not be binding upon Owner and Bidder shall not rely upon them.

19. All questions must be submitted in writing as follows. Phone calls are not permitted.

16.1 All questions must be sent to:
Kevin Miller (kevinmiller@breslinarchitects.com)
Breslin Ridyard Fadero Architects

16.2 All Mechanical and Plumbing related questions must be copied to:
Dave Derkits (derkits@lve.cc)
Lehigh Valley Engineering

16.3 All Electrical related questions must be copied to:
Chad Derstine (derstine@lve.cc)
Lehigh Valley Engineering

DELIVERY OF PROPOSALS

20. Each proposal must be delivered by the Bidder to the Eastern Center for Arts and Technology located at 3075 Terwood Road, Willow Grove, Pennsylvania 19090 until the prevailing time and date stated in the “Advertisement for Bids.” Envelopes containing proposals shall be sealed and the name of the bidder and the contract that is being bid shall be marked in the upper left hand corner. Envelopes shall be addressed to Katie Braun, Business Manager, Eastern Center for Arts and Technology.

OPENING OF PROPOSALS

21. Proposals will be opened and read on the date and at the location stated in the “Advertisement for Bids” commencing after the prevailing time for receiving bids. Bidders or their authorized agents should be present. Bids received by the Owner after the time and date set for opening, will not be opened or considered.

WITHDRAWAL OF PROPOSALS

22. Bidders will be given permission to withdraw any proposal after it has been received by the Owner, provided the bidder or his agent duly authorized to act for him, personally appears

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at the meeting place of the Owner with a written request signed by the bidder prior to the time set for the opening of the proposals. At the time set for the opening of proposals, the withdrawn proposal will be returned to the bidder. Such proposals will not be opened or read at the bid opening. Bids may not be modified after submittal.

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

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

IRREGULAR PROPOSALS

25. Proposals indicating a qualification of the bid, conditions or uninvited alternate bids or which contain alteration of the form request for proposal, or additions or deductions not called for shall be rejected. Bids containing minor irregularities or informalities, not relating to price, time, or changes affecting the quality of work, may be rejected at Owner's sole discretion. Owner reserves the right to waive any such informalities or irregularities.

26. In the event the unit prices submitted by the Contractor are unreasonable and not consistent with the work involved or not comparable to other unit prices received, as determined by the Architect, the Owner reserves the right to negotiate a mutually agreed suitable Unit Price before awarding the Contract.

COLLUSIVE BIDS WILL BE REJECTED

27. More than one proposal for one contract from an individual, partnership, corporation, or an association under the same or different names will be grounds for the rejection of all proposals in which such bidder is interested. Any or all proposals will be rejected if there is reason for believing that collusion exists among any of the bidders. Participants in such collusion will not be considered in future proposals.

28. A Non-Collusion Affidavit shall be executed and submitted in duplicate with the Contractor's proposal using the form set forth herein.

PROPOSAL MISTAKE CLAIMS

29. Negligence by the Bidder in preparing his Bid confers no right of withdrawal or modification of his Bid after such Bid has been opened. No claims on account of mistakes or omissions of any Bid will be considered. Notwithstanding the above, a bidder may withdraw his bid within two (2) business days after the bid opening time in accordance with The Public Contracts - Withdrawal of Bids Law, Act of January 23, 1974, P.L. 9, No. 4, 73 P.S. Sec. 1601 *et seq.* as amended. A bid that has been opened may be withdrawn only in accordance with

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the causes set forth in said Act and for no other reasons. Strict compliance with said Act is required to withdraw a bid after bid opening.

AWARD OF CONTRACT

30. The Owner's intent is to enter into Contracts with the lowest possible and qualified Bidders. In evaluating Bids, the Owner will consider the qualifications of Bidders as provided in Paragraph 15 above.

31. The Owner reserves the right to reject any or all proposals, or any part thereof or items therein, and to waive technicalities, as it may deem best to protect the interest of the Owner. If any award is made by the Owner, it will be to the party declared by the Owner to be the lowest responsible bidder, within sixty (60) days from the date of the opening of proposals unless the award of contract is delayed due to required approvals of other governmental agencies, the sale of bonds, or the award of a grant or grants, in which case, an award may be made within 120 days from the date of opening of proposals in accordance with Act 317 of 1978, 73 P.S. §1621, *et seq.* This time may be extended by mutual written consent of the Owner and lowest responsible bidder.

STANDARD OF QUALITY

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

33. No substitutions (alternatives) will be considered prior to receipt of Bids unless a written request for approval from a Prime Contract Bidder has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall be in accordance with Specification Section 012500 "Substitution Procedures" and any other requirements at the Architect, and Owner's discretion.

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

- Manufacturer's product data, technical and warranty information. A line-by-line comparison of all specified items in the Specification must be made.

**C-6
INSTRUCTIONS TO BIDDERS**

- Architect will review submission and any acceptable substitutions will be listed in an addendum. All manufacturers not specifically approved by addendum shall not be considered.
- Only manufacturers that are qualified prior to the Bid Opening will be considered acceptable Manufacturers.

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

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

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

TIME OF COMPLETION

38. The Bidder acknowledges that a condition of the Contract is that time is of the essence of the Contract and the number of calendar days within which, or the dates by which, the Work is to be substantially completed and ready for final payment (the Contract Time) are set forth in Section 011100 "Summary of Work" and are accepted by the Bidder without exception or conditions.

LIQUIDATED DAMAGES

39. Provisions for liquidated damages are set forth in the "Agreement Between Owner and Contractor."

EXECUTION OF CONTRACT AND BONDS

40. The Owner will notify the lowest responsible bidder of the Owner's intent to accept his proposal and to make a formal award of contract to him by a "Notice of Intent to Award." The Owner will include with the Notice of Intent to Award the "Agreement Between Owner and Contractor" to be signed by the Successful Bidder. Within ten (10) days of receipt of the Notice of Award, the Successful Bidder shall furnish (1) a Performance Bond and a Labor and Material Payment Bond in the forms provided in the Bidding Documents, each in the amount of one hundred percent (100%) of the contract sum; (2) Certificates of Insurance as required pursuant to Article 11 of the General Conditions of the Contract; and (3) the signed Agreement Between Owner and Contractor. Five (5) originals of each of the Bonds, Insurance Certificates, and Agreements shall be submitted to the Architect's office within the required time period.

41. All bonds and insurances shall be issued by companies authorized to transact business in the Commonwealth of Pennsylvania and which are acceptable to the Owner. Sureties must be listed in the latest Department of the Treasury, Department Circular 570 titled "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" and the amount of the bonds shall not exceed the underwriting risk of such Surety as set forth in said circular or revision thereof.

C-7 INSTRUCTIONS TO BIDDERS

42. The attorney-in-fact who executes the Labor and Material Payment and Performance Bonds on behalf of the Surety shall affix to the Bonds a certified and current copy of its Power of Attorney, authorizing said attorney-in-fact to act on behalf of the Surety. The Power of Attorney must be dated the same date as the Bonds and both the Bonds and Power of Attorney shall have affixed the raised corporate seal of the Surety.

43. After approval of bonds and insurance, the Owner will sign and date the Agreement Between Owner and Contractor. Owner shall return to the successful Bidder one copy of the dated, executed Agreement Between Owner and Contractor within 60 days of the date that the contract is awarded, unless the time of issuance of such agreement shall be extended by mutual written agreement of the Owner and successful Bidder.

FAMILIARITY WITH PROPOSED WORK

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

FAILURE TO EXECUTE CONTRACT

45. Failure of the Bidder to whom notice of intent to award has been given to deliver appropriate payment and performance bonds, certificates of insurance, or execute the contract within the time specified, shall constitute a default by such Bidder and the Owner may, at its sole discretion, award the contract to the next lowest responsible Bidder or re-advertise for bids, and the defaulting Bidder shall pay to the Owner the difference between the amount of his bid and any higher amount for which the Owner may contract for the required work, plus any advertising, architectural, legal or other expenses incurred by reason of the default. The Bid Security of such defaulting Bidder shall be applied on account of said damages, and if the amount of said damages exceeds the amount of the Bid Security, the defaulting Bidder shall pay to the Owner the full amount of the excess. The Owner may, in its sole discretion, extend the time period for submission of the above items, upon request of Bidder. Such request of Bidder, if accepted by Owner in writing, shall constitute a mutual agreement to extend the date for issuance of the agreement by Owner to the date stipulated in such written agreement, or if no date is stipulated, until 20 business days after the submission to the Owner of the properly executed agreement and all required documents in proper form as required by the Contract Documents.

C-8 INSTRUCTIONS TO BIDDERS

SUB-LETTING OR ASSIGNING OF CONTRACT

46. The Contractor shall not sublet, sell, transfer, assign, or otherwise dispose of the contract, or any portion thereof, or of his rights, title or interest therein, without the written consent of the Owner.

START OF WORK

47. The time of completion of this contract has been established on the basis that the Contractor shall start work immediately upon receipt of the “Notice to Proceed” and it shall be agreed that work shall proceed uninterrupted and without delay by Contractor to Substantial Completion.

PREVENTION OF ENVIRONMENTAL POLLUTION

48. Section 3301 of the Pennsylvania Commonwealth Procurement Code requires that all invitations for Bids and requests for proposals for construction projects issued by any governmental agency shall set forth any provision of Federal and State statutes, rules, and regulations dealing with the prevention of environmental pollution and the preservation of public natural resources that affect the projects. In this regard, attached to these specifications is a Notice of said provisions prepared by the Pennsylvania Department of Environmental Resources under Act 247 of 1972, 53 P.S. § 1612 (repealed). Contractor is hereby notified and agrees to comply with the terms of all statutes, rules and regulations enumerated in said Notice. Where any identified environmental statute, rule and/or regulation has been revised, amended, supplemented, replaced and/or supplanted, Contractor shall comply with such statute, rule and/or regulation as so modified. Notwithstanding the foregoing, failure to include any applicable environmental statute, rule and/or regulation in the Contract Documents shall not relieve Contractor of its obligation to comply with the same.

DISCREPANCIES

49. In case of discrepancies between the contract documents, the agreement shall take precedence over the drawings and specifications.

50. In every case, the Architect will be the interpreter of the requirements of the contract documents and all interpretations and written decisions of the Architect shall be consistent with the intent of the contract documents.

GOVERNMENT REQUIREMENTS

51. Bids shall be submitted on the basis of full and total compliance with all Federal and State laws, regulations, statutes and requirements pertaining to this project. Bidder shall refer to Article 17 of the General Conditions of the Contract for additional requirements.

52. Bidder shall contact prior to Bidding, the local municipality having jurisdiction and ascertain the building codes, permits, fees, and regulations pertaining to this project. It is the responsibility of the Bidder to determine what local ordinances, if any, will affect his work. He should check for any county, city, borough, or township rules and regulations applicable to the area in which the project is being constructed and, in addition, for any rules or regulations of

**C-9
INSTRUCTIONS TO BIDDERS**

other organizations having jurisdiction such as planning commissions, industries or utility companies. Any costs of compliance with local controls shall be included in the prices bid, even though requirements of such local controlling agencies are not listed herein.

PREVAILING WAGES

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

CASH ALLOWANCES

54. Cash allowances are not included in the Bid Documents, nor are they otherwise applicable to the project.

TAXES

55. Contractor shall be responsible for and shall pay all applicable sales, use, excise or other taxes required by law on all materials, tools, apparatus, equipment, fixtures, services, incidentals or otherwise which may be purchased or used in connection with the Work or portions thereof. The Bid shall be made in accordance with such laws and shall include all applicable taxes in the Bid amount. Notwithstanding the foregoing, however, Owner is exempt (excluded) from sales and/or use tax in Pennsylvania on certain transactions. Contractor and all subcontractors shall bid and shall purchase as exempt (excluded) from Pennsylvania sales and/or use tax all tangible personal property within the definition of 'building machinery and equipment' as that term is defined in Act No. 45-1998 (72 P.S. § 7201 et seq.). No charges shall be allowed for such exempt items. It shall be the Contractor's responsibility to determine those items for which an exemption will apply, and the Contractor shall obtain legal or other tax advice to determine how and to what extent an exemption from the taxes apply. In order to facilitate such purchase free of sales and/or use tax in Pennsylvania, and upon certification by Contractor that an item is, in fact, tax exempt, the Owner agrees to execute a tax exemption certificate prepared by Contractor or a subcontractor as may be required by the regulations of the Pennsylvania Department of Revenue.

56. Assignment of Refund Rights: Owner shall be entitled to claim refunds of sales and/or use tax paid on these and other purchases of tangible personal property required in connection with the Work. The Contractor and all subcontractors hereby assign to Owner all rights to any such refund claim and to any resulting refund and hereby appoint the Owner as their Attorney-in-Fact to execute and acknowledge in their respective names and to prosecute such refund claims before administrative agencies and courts in Pennsylvania having jurisdiction over such claims. The Owner or its agent shall have the right to review the books and records of the Contractor and all subcontractors for the purpose of documenting and substantiating any such refund claim. Contractor and all subcontractors shall cooperate fully with Owner in pursuing any such refund claim and shall make available to the Owner any applicable documents.

**C-10
INSTRUCTIONS TO BIDDERS**

57. 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 the Contract, and the system shall be satisfactory to Owner. The Owner or its representative shall be afforded access to, including the right to photocopy, all the Contractor's records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Work, and the Contractor shall preserve all such records for a period of three (3) years, or for such longer period as may be required by the law, after receipt of final payment.

58. The Contractor agrees to include the "Access to Accounting Records" and "Assignment of Refund Rights" paragraphs, in full, in any contracts with subcontractors. The Contractor further agrees that it will not file a claim for refund for any sales and/or use tax which is the subject of the assignment in Section 55 above. Contractor shall obtain from all subcontractors similar agreements that they will not file claims for refund for any sales and/or use tax which is the subject of the assignment in Section 55 above.

GENERAL CONSTRUCTION BID FORM – PROPOSAL

**INTERIOR ALTERATIONS – PHASE 3
for the
EASTERN CENTER for ARTS and TECHNOLOGY
WILLOW GROVE, MONTGOMERY COUNTY, PENNSYLVANIA**

PROPOSAL OF:

Bidder: _____

Address: _____

Telephone: _____ Telecopier: _____

Contact Person: _____ Email: _____

Proposal for: GENERAL CONSTRUCTION

To: EASTERN CENTER FOR ARTS AND TECHNOLOGY

Date _____

In conformity with the plans and specifications as prepared by Breslin Ridyard Fadero Architects, 1226 Union Boulevard, Allentown, Pennsylvania, and after an examination of the site of the work and the Contract Documents, including Advertisement for Bids, Instructions to Bidders, this Bid Form-Proposal, Agreement Between Owner and Contractor, Bid Bond, Payment Bond, Performance Bond, and General Conditions of the Contract, including all addenda, the undersigned submits this proposal and encloses herewith, as a proposal guaranty, a certified check, bank cashier's check, trust company treasurer's check, or Bid Bond, (in an amount of not less than ten percent (10%) of the sum of the hereinafter stated base bid) naming as payee or obligee, as appropriate, **Eastern Center for Arts and Technology**, which guaranty it is understood will be forfeited to and retained by the Owner as liquidated damages if the undersigned shall fail to furnish satisfactory payment and performance bonds and insurance certificates or if this proposal is accepted by the Owner and the undersigned shall fail to execute the contract all as required by the provisions of the contract documents. Should the Owner fail to make an award on this project through no fault or failure on the part of this bidder, then the Owner shall return said guaranty.

Attached to this proposal and proposal guaranty is an Agreement of Surety certifying that a surety company will provide the bidder with a Performance Bond and Labor and Material Payment Bond each in the amount of 100% of the contract amount. A Contractor's Qualification Statement is also attached hereto. The financial statement does not have to be submitted with the proposal. The Contractor will be required to furnish their financial statement within three days if requested by the Owner after the opening of proposals.

**D-1
GENERAL CONSTRUCTION BID FORM – PROPOSAL**

It is hereby certified that the undersigned is the only person(s), firm, or corporation interested in this proposal as principal, and that the proposal is made without collusion with any person, firm or corporation. A Non-Collusion Affidavit is attached to this proposal.

Bidder guarantees that, if awarded the contract, he/she will furnish and deliver all materials, tools, equipment, tests, transportation, secure all permits and licenses, do and perform all labor, superintendence and all means of construction, pay all fees and do all incidental work, to execute, construct and finish in an expeditious, substantial and workmanlike manner, in accordance with the plans and specifications, to the complete satisfaction and acceptance of the Owner, for the prices hereinafter stated.

It is understood that the Owner reserves the right to reject any/or all proposals, or part thereof or items therein and to waive technicalities determined for the best interests of the Owner. It is further understood that competency and responsibility of bidders will receive consideration before the award of the contract.

CONTRACT COMPLETION TIME

Bidder submits this proposal with the understanding that the Work to be performed under this Contract for Construction shall be commenced immediately after receipt by the Contractor of written "Notice To Proceed" from the Owner, and unless extended by the Owner pursuant to the General Conditions, shall be Substantially Completed as indicated in Section 011000 "Summary of Work", Paragraph 1.5 "Work Sequence" in accordance with the definition of Substantial Completion in the General Conditions.

The completion of the Work shall be considered of the essence of this contract, and the Owner shall be entitled to the fixed sum of One Thousand Dollars (\$1,000.00) liquidated damages for each and every calendar day beyond the Date of Substantial Completion for each Contract, subject to extensions as provided for in the General conditions of the Contract.

Additionally the Owner shall be entitled to a fixed sum of Two Hundred Fifty Dollars (\$250.00) liquidated damages for each and every calendar day that the full completion of the project including the List of Deficiencies (Punch List) is not achieved commencing the thirtieth (30th) calendar day after Substantial Completion until full completion is achieved.

The Contractors acknowledges receipt of the following Bulletins and/or Addenda:

BULLETINS AND/OR ADDENDA

DATE

| | |
|-------|-------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

CONTRACT DRAWINGS

The Bidder hereby acknowledges that he has received a complete set of drawings of all prime contracts during the bidding period.

YES _____

NO _____

BASE BID

GENERAL CONSTRUCTION _____
_____ (\$ _____)

ALTERNATE BIDS

Insert the total net amount to be added to or deducted from the Base Bid for each Alternate Item Bid by completing the appropriate section (either “Add” or “Deduct”) under each Alternate Item Bid number. The Bidder agrees that the Owner shall have the right to accept or reject any or all of the following Alternates, which acceptance or rejection shall enter into the determination of the low bidder. The Bidder acknowledges that the Contract Time shall not be increased on account of the acceptance of any one or combination of alternates.

Bidder shall enter a response to all requested Alternates. If no change in the Base Bid is required for an Alternate, enter “No Change.” If the bidder is not providing a bid for an Alternate, enter “No Bid.” If no response is provided, including entering “No Bid”, and the Owner elects to accept that Alternate, the Alternate Bid shall be treated conclusively as a bid for zero dollars for the work described, or the Bidder’s Proposal may be rejected, at the Owner’s sole discretion.

ALTERNATE No. A-1

The Contractor shall state the difference in price from the Base Bid should the Owner decide to ADD an acoustical panel ceiling system in Protective Services A109 specified in Section 095113 “Acoustical Panel Ceilings” and as indicated on the Drawings.

ADD _____ (\$ _____)

ALTERNATE No. A-2

The Contractor shall state the difference in price from the base bid should the Owner decide to remove the existing acoustical panel ceiling system in its entirety and furnish and install a new acoustical panel ceiling system specified in Section 095113 “Acoustical Panel Ceilings” in Exercise Science B101, Theory Classroom B103, Office B104, Theory Classroom B105, and Office B106 as indicated on the Drawings.

ADD _____ (\$ _____)

**D-3
GENERAL CONSTRUCTION BID FORM – PROPOSAL**

The undersigned agrees that the following shall constitute the Unit Prices to be applicable to additions to or deductions from the quantities contemplated by the Contract Documents by reason of changes to the Contract Documents in the course of performance of the contemplated work:

- A. \$ _____ per square foot of hydraulic cement underlayment with a uniform depth of 1/2-inch installed.
- B. \$ _____ per square foot of existing acoustical panel ceiling system to be removed and replaced with new Acoustical Ceiling Panels (Type AP-1) and related suspension system.
- C. \$ _____ per linear foot to provide 10'-0" high by 6-inch thick CMU partition with all required reinforcing and paint finish both sides.
- D. \$ _____ per ton for miscellaneous steel for lintels; roof opening headers and miscellaneous angles, plates, etc. including fabrication, shop priming, delivery to site and installation.
- E. \$ _____ per 50 patched and repaired holes in concrete masonry unit walls; 2-inch diameter or less in size.
- F. \$ _____ per 50 patched and repaired holes in concrete masonry unit walls; 2-inches to 6-inches in diameter.
- G. \$ _____ per square foot of new 8-inch thick concrete floor slab-on-grade with welded wire fabric reinforcing.
- H. \$ _____ per square foot of existing concrete floor slab-on-grade saw-cut and removed. (Assume existing concrete floor slab is 8-inches thick).

MATERIAL ALLOWANCES

The undersigned further certifies that he has included the following "Material Allowances" in the above bid. The Owner shall receive a reduction in the Contract Price for any unused quantities included in the Material Allowance, pursuant to a deduct Change Order, based on their respective Unit Price(s). Unit Prices will govern for quantities exceeding the Material Allowances:

- A. 2,000 sq. ft. of hydraulic cement underlayment installed. \$ _____
(2,000 x A from the unit prices above)
- B. 300 square feet of acoustical panel ceiling system removed and replaced. \$ _____
(300 x B from the Unit Prices above)
- C. 60 linear feet of 10'-0" high by 6-inch thick CMU partition with all required reinforcing and paint finish both sides. \$ _____
(60 x C from the Unit Prices above)

| | | |
|----|--|----------|
| D. | 1 ton of miscellaneous steel, installed (1 x 'D' from the Unit Prices above) | \$ _____ |
| E. | 250 patched and repaired holes; 2-inch diameter or less in size. (5 x E from the Unit Prices above) | \$ _____ |
| F. | 250 patched & repaired holes; 2-inches to 6-inches in diameter. (5 x F from the Unit Prices above) | \$ _____ |
| G. | 500 sq. ft. of new concrete floor slab installed. (500 x 'G' from the Unit Prices above) | \$ _____ |
| H. | 500 sq. ft. of existing concrete floor slab saw-cut and removed (500 x 'H' from the Unit Prices above) | \$ _____ |

The undersigned agrees that:

- (1) the Contract Documents are incorporated herein by reference and shall be construed to be part hereof, with the same effect as if such were reported at length herein, or were physically attached hereto;
- (2) this proposal is genuine and is not sham, collusive or fraudulent;
- (3) this proposal is not made in the interest or in behalf of any persons other than the undersigned;
- (4) the undersigned has not sought in any manner, by collusion or otherwise, to secure any advantage over any other bidder;
- (5) he/she will not assign his bid or any of his rights or interest thereunder without the written consent of the Owner.

**D-5
GENERAL CONSTRUCTION BID FORM – PROPOSAL**

SIGNATURES

When the Bidder is an Individual:

WITNESS:

_____(SEAL)
Signature of Individual

Trading and doing business as:

Address

**D-6
GENERAL CONSTRUCTION BID FORM – PROPOSAL**

When the Bidder is a Partnership (Name of Partners):

WITNESS:

Name of Partnership

Address

BY: _____ (SEAL)
Partner

BY: _____ (SEAL)
Partner

BY: _____ (SEAL)
Partner

BY: _____ (SEAL)
Partner

**D-7
GENERAL CONSTRUCTION BID FORM – PROPOSAL**

When the Bidder is a Corporation:

ATTEST:

Name of Corporation

Address

Secretary/Assistant Secretary

BY: _____
President/Vice President

(CORPORATE SEAL)

_____ is a corporation organized and existing under the laws of _____ and has (has not) been granted a certificate of authority to do business in the State of Pennsylvania.

When the Bidder is a Limited Liability Company:

WITNESS:

Name of Limited Liability Company

BY: _____ (SEAL)
(Managing) Member

BY: _____ (SEAL)
Member

BY: _____ (SEAL)
Member

or (if appropriate)

WITNESS:

Name of Limited Liability Company

*BY: _____ (SEAL)
(Authorized Representative)

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

**D-9
GENERAL CONSTRUCTION BID FORM – PROPOSAL**

MECHANICAL CONSTRUCTION BID FORM – PROPOSAL

**INTERIOR ALTERATIONS – PHASE 3
for the
EASTERN CENTER for ARTS and TECHNOLOGY
WILLOW GROVE, MONTGOMERY COUNTY, PENNSYLVANIA**

PROPOSAL OF:

Bidder: _____

Address: _____

Telephone: _____ Telecopier: _____

Contact Person: _____ Email: _____

Proposal for: MECHANICAL CONSTRUCTION

To: EASTERN CENTER FOR ARTS AND TECHNOLOGY

Date _____

In conformity with the plans and specifications as prepared by Breslin Ridyard Fadero Architects, 1226 Union Boulevard, Allentown, Pennsylvania, and after an examination of the site of the work and the Contract Documents, including Advertisement for Bids, Instructions to Bidders, this Bid Form-Proposal, Agreement Between Owner and Contractor, Bid Bond, Payment Bond, Performance Bond, and General Conditions of the Contract, including all addenda, the undersigned submits this proposal and encloses herewith, as a proposal guaranty, a certified check, bank cashier's check, trust company treasurer's check, or Bid Bond, (in an amount of not less than ten percent (10%) of the sum of the hereinafter stated base bid) naming as payee or obligee, as appropriate, **Eastern Center for Arts and Technology**, which guaranty it is understood will be forfeited to and retained by the Owner as liquidated damages if the undersigned shall fail to furnish satisfactory payment and performance bonds and insurance certificates or if this proposal is accepted by the Owner and the undersigned shall fail to execute the contract all as required by the provisions of the contract documents. Should the Owner fail to make an award on this project through no fault or failure on the part of this bidder, then the Owner shall return said guaranty.

Attached to this proposal and proposal guaranty is an Agreement of Surety certifying that a surety company will provide the bidder with a Performance Bond and Labor and Material Payment Bond each in the amount of 100% of the contract amount. A Contractor's Qualification Statement is also attached hereto. The financial statement does not have to be submitted with the proposal. The Contractor will be required to furnish their financial statement within three days if requested by the Owner after the opening of proposals.

**D-1
MECHANICAL CONSTRUCTION BID FORM – PROPOSAL**

It is hereby certified that the undersigned is the only person(s), firm, or corporation interested in this proposal as principal, and that the proposal is made without collusion with any person, firm or corporation. A Non-Collusion Affidavit is attached to this proposal.

Bidder guarantees that, if awarded the contract, he/she will furnish and deliver all materials, tools, equipment, tests, transportation, secure all permits and licenses, do and perform all labor, superintendence and all means of construction, pay all fees and do all incidental work, to execute, construct and finish in an expeditious, substantial and workmanlike manner, in accordance with the plans and specifications, to the complete satisfaction and acceptance of the Owner, for the prices hereinafter stated.

It is understood that the Owner reserves the right to reject any/or all proposals, or part thereof or items therein and to waive technicalities determined for the best interests of the Owner. It is further understood that competency and responsibility of bidders will receive consideration before the award of the contract.

CONTRACT COMPLETION TIME

Bidder submits this proposal with the understanding that the Work to be performed under this Contract for Construction shall be commenced immediately after receipt by the Contractor of written "Notice To Proceed" from the Owner, and unless extended by the Owner pursuant to the General Conditions, shall be Substantially Completed as indicated in Section 011000 "Summary of Work", Paragraph 1.5 "Work Sequence" in accordance with the definition of Substantial Completion in the General Conditions.

The completion of the Work shall be considered of the essence of this contract, and the Owner shall be entitled to the fixed sum of One Thousand Dollars (\$1,000.00) liquidated damages for each and every calendar day beyond the Date of Substantial Completion for each Contract, subject to extensions as provided for in the General conditions of the Contract.

Additionally the Owner shall be entitled to a fixed sum of Two Hundred Fifty Dollars (\$250.00) liquidated damages for each and every calendar day that the full completion of the project including the List of Deficiencies (Punch List) is not achieved commencing the thirtieth (30th) calendar day after Substantial Completion until full completion is achieved.

The Contractors acknowledges receipt of the following Bulletins and/or Addenda:

| <u>BULLETINS AND/OR ADDENDA</u> | <u>DATE</u> |
|--|--------------------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

These Contract Documents have been prepared specifically for this Project and may only be used solely with respect to this Project. The Architect retains all common law, statutory, and other reserved rights, including copyright.

CONTRACT DRAWINGS

The Bidder hereby acknowledges that he has received a complete set of drawings of all prime contracts during the bidding period.

YES _____

NO _____

BASE BID

MECHANICAL CONSTRUCTION _____

_____ (\$ _____)

ALTERNATE BIDS

Insert the total net amount to be added to or deducted from the Base Bid for each Alternate Item Bid by completing the appropriate section (either “Add” or “Deduct”) under each Alternate Item Bid number. The Bidder agrees that the Owner shall have the right to accept or reject any or all of the following Alternates, which acceptance or rejection shall enter into the determination of the low bidder. The Bidder acknowledges that the Contract Time shall not be increased on account of the acceptance of any one or combination of alternates.

Bidder shall enter a response to all requested Alternates. If no change in the Base Bid is required for an Alternate, enter “No Change.” If the bidder is not providing a bid for an Alternate, enter “No Bid.” If no response is provided, including entering “No Bid”, and the Owner elects to accept that Alternate, the Alternate Bid shall be treated conclusively as a bid for zero dollars for the work described, or the Bidder’s Proposal may be rejected, at the Owner’s sole discretion.

ALTERNATE No. M-1

The Contractor shall state the difference in price from the Base Bid should the Owner decide to ADD an acoustical panel ceiling system in Protective Services A109 (Furnished by GC). Provide ceiling mounted supply air diffusers, ceiling mounted return air grilles, and branch ductwork in lieu of duct-mounted registers. Provide external duct insulation on supply ductwork above ceiling.

ADD _____ (\$ _____)

DEDUCT _____ (\$ _____)

ALTERNATE No. M-2

The Contractor shall state the difference in price from the base bid should the Owner decide to proceed with HVAC improvements in Theory Classroom B103, Office B104, Theory Classroom B105, and Office B106 as indicated on the Drawings. Provide HVAC demolition and provide VAV boxes VAV-103-3 and VAV-103-4 and all associated ductwork, diffusers and grilles,

**D-3
MECHANICAL CONSTRUCTION BID FORM – PROPOSAL**

hydronic piping, and controls. Removal of existing ceiling system and installation of new acoustical panel ceiling shall be by the General Contractor

ADD _____ (\$ _____)

DEDUCT _____ (\$ _____)

ALTERNATE No. M-3

The Contractor shall state the difference in price from the base bid should the Owner decide to have the Mechanical Contractor furnish dust collectors DCU-1 and DCU-2 and welding fume extractor arms (Quantity 20) in lieu of owner furnished equipment.

ADD _____ (\$ _____)

UNIT PRICES

The undersigned agrees that the following shall constitute the unit prices for each project to be applicable to additions to or deductions from the quantities contemplated by the Contract Documents by reason of changes to the Contract Documents in the course of performance of the contemplated work:

- A. \$ _____ per pound of galvanized sheet metal ductwork, installed, including hangers and supports.
- B. \$ _____ per square foot to furnish and install 2.25 inch thick, duct wrap insulation.
- C. \$ _____ furnish and install one 24 inch x 24-inch ceiling mounted supply air diffuser including manual balancing damper.
- D. \$ _____ per lineal foot of 1/2-inch copper pipe, domestic hot water, insulated and installed, including hangers and supports
- E. \$ _____ per lineal foot of 2-inch black steel pipe, insulated and installed, including hangers and supports
- F. \$ _____ per 1/2-inch domestic water ball valve, installed.
- G. \$ _____ per 2-inch ball valve, installed.
- H. \$ _____ per space temperature sensor, including heavy-duty guard, wiring and programming.
- I. \$ _____ per VAV terminal DDC controller including actuator, 3/4" control valve, wiring and programming.

MATERIAL ALLOWANCES

The undersigned further certifies that he has included the following "Material Allowances" in the above base bid. Unused allowances shall be returned to the Owner using the remaining quantities and their respective unit price. Unit prices will govern for quantities exceeding the following allowances:

- A. 1,000 pounds of insulated galvanized steel ductwork \$ _____
Installed in a size, shape, and location as directed by the Architect. Installation shall include duct, fittings, and supports for an installation height of 12'-0" AFF.
(1,000 x A from the unit prices above)
- B. 1,000 square feet of installed 2.25 inch thick, duct wrap fiberglass duct insulation, installed. \$ _____
(1,000 x B from the unit prices above)
- C. 12 additional 24" x 24" ceiling mounted supply air diffusers including manual balancing dampers, installed where directed by the Architect \$ _____
(12 x C from the unit prices above)
- D. 100 linear feet of ½-inch insulated domestic hot water pipe, including hangers, and fittings \$ _____
for an installation height of 12'-0" AFF.
(100 x D from the unit prices above)
- E. 100 linear feet of 2-inch insulated black steel pipe, including hangers, and fittings \$ _____
for an installation height of 12'-0" AFF.
(100 x E from the unit prices above)
- F. 12 additional 1/2-inch ball valves installed. \$ _____
(12 x F from the unit prices above)
- G. 12 additional 2-inch ball valves installed. \$ _____
(12 x G from the unit prices above)
- H. 6 additional space temperature sensors including heavy-duty guard, wiring and programming. \$ _____
(6 x H from the unit prices above)
- I. 4 VAV terminals DDC controllers installed where \$ _____
directed by the Architect.
(4 x I from the unit prices above)

The undersigned agrees that:

- (1) the Contract Documents are incorporated herein by reference and shall be construed to be part hereof, with the same effect as if such were reported at length herein, or were physically attached hereto;
- (2) this proposal is genuine and is not sham, collusive or fraudulent;
- (3) this proposal is not made in the interest or in behalf of any persons other than the undersigned;
- (4) the undersigned has not sought in any manner, by collusion or otherwise, to secure any advantage over any other bidder;
- (5) he/she will not assign his bid or any of his rights or interest thereunder without the written consent of the Owner.

SIGNATURES

When the Bidder is an Individual:

WITNESS:

_____(SEAL)
Signature of Individual

Trading and doing business as:

Address

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MECHANICAL CONSTRUCTION BID FORM – PROPOSAL**

When the Bidder is a Partnership (Name of Partners):

WITNESS:

Name of Partnership

Address

BY: _____(SEAL)
Partner

BY: _____(SEAL)
Partner

BY: _____(SEAL)
Partner

BY: _____(SEAL)
Partner

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MECHANICAL CONSTRUCTION BID FORM – PROPOSAL**

When the Bidder is a Corporation:

ATTEST:

Name of Corporation

Address

Secretary/Assistant Secretary

BY: _____
President/Vice President

(CORPORATE SEAL)

_____ is a corporation organized and existing
under the laws of _____ and has (has not)
been granted a certificate of authority to do business in the State of Pennsylvania.

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MECHANICAL CONSTRUCTION BID FORM – PROPOSAL**

When the Bidder is a Limited Liability Company:

WITNESS:

Name of Limited Liability Company

BY: _____(SEAL)
(Managing) Member

BY: _____(SEAL)
Member

BY: _____(SEAL)
Member

or (if appropriate)

WITNESS:

Name of Limited Liability Company

*BY: _____(SEAL)
(Authorized Representative)

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

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MECHANICAL CONSTRUCTION BID FORM – PROPOSAL**

ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL

**INTERIOR ALTERATIONS – PHASE 3
for the
EASTERN CENTER for ARTS and TECHNOLOGY
WILLOW GROVE, MONTGOMERY COUNTY, PENNSYLVANIA**

PROPOSAL OF:

Bidder: _____

Address: _____

Telephone: _____

Telecopier: _____

Contact Person: _____

Email: _____

Proposal for: ELECTRICAL CONSTRUCTION

To: EASTERN CENTER FOR ARTS AND TECHNOLOGY

Date _____

In conformity with the plans and specifications as prepared by Breslin Ridyard Fadero Architects, 1226 Union Boulevard, Allentown, Pennsylvania, and after an examination of the site of the work and the Contract Documents, including Advertisement for Bids, Instructions to Bidders, this Bid Form-Proposal, Agreement Between Owner and Contractor, Bid Bond, Payment Bond, Performance Bond, and General Conditions of the Contract, including all addenda, the undersigned submits this proposal and encloses herewith, as a proposal guaranty, a certified check, bank cashier's check, trust company treasurer's check, or bid bond, (in an amount of not less than ten percent (10%) of the sum of the hereinafter stated base bid) naming as payee or obligee, as appropriate, **Eastern Center for Arts and Technology**, which guaranty it is understood will be forfeited to and retained by the Owner as liquidated damages if the undersigned shall fail to furnish satisfactory payment and performance bonds and insurance certificates or if this proposal is accepted by the Owner and the undersigned shall fail to execute the contract all as required by the provisions of the contract documents. Should the Owner fail to make an award on this project through no fault or failure on the part of this bidder, then the Owner shall return said guaranty.

Attached to this proposal and proposal guaranty is an Agreement of Surety certifying that a surety company will provide the bidder with a Performance Bond and Labor and Material Payment Bond each in the amount of 100% of the contract amount. A Contractor's Qualification Statement is also attached hereto. The financial statement does not have to be submitted with the proposal. The Contractor will be required to furnish their financial statement within three days if requested by the Owner after the opening of proposals.

**D-1
ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL**

It is hereby certified that the undersigned is the only person(s), firm, or corporation interested in this proposal as principal, and that the proposal is made without collusion with any person, firm or corporation. A Non-Collusion Affidavit is attached to this proposal.

Bidder guarantees that, if awarded the contract, he/she will furnish and deliver all materials, tools, equipment, tests, transportation, secure all permits and licenses, do and perform all labor, superintendence and all means of construction, pay all fees and do all incidental work, to execute, construct and finish in an expeditious, substantial and workmanlike manner, in accordance with the plans and specifications, to the complete satisfaction and acceptance of the Owner, for the prices hereinafter stated.

It is understood that the Owner reserves the right to reject any/or all proposals, or part thereof or items therein and to waive technicalities determined for the best interests of the Owner. It is further understood that competency and responsibility of bidders will receive consideration before the award of the contract.

CONTRACT COMPLETION TIME

Bidder submits this proposal with the understanding that the Work to be performed under this Contract for Construction shall be commenced immediately after receipt by the Contractor of written "Notice To Proceed" from the Owner, and unless extended by the Owner pursuant to the General Conditions, shall be Substantially Completed as indicated in Section 011000 "Summary of Work", Paragraph 1.5 "Work Sequence" in accordance with the definition of Substantial Completion in the General Conditions.

The completion of the Work shall be considered of the essence of this contract, and the Owner shall be entitled to the fixed sum of One Thousand Dollars (\$1,000.00) liquidated damages for each and every calendar day beyond the Date of Substantial Completion for each Contract, subject to extensions as provided for in the General conditions of the Contract.

Additionally the Owner shall be entitled to a fixed sum of Two Hundred Fifty Dollars (\$250.00) liquidated damages for each and every calendar day that the full completion of the project including the List of Deficiencies (Punch List) is not achieved commencing the thirtieth (30th) calendar day after Substantial Completion until full completion is achieved.

The Contractors acknowledges receipt of the following Bulletins and/or Addenda:

BULLETINS AND/OR ADDENDA

DATE

| | |
|-------|-------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

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ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL**

CONTRACT DRAWINGS

The Bidder hereby acknowledges that he has received a complete set of drawings of all prime contracts during the bidding period.

YES _____

NO _____

BASE BID

ELECTRICAL CONSTRUCTION _____

_____ (\$ _____)

ALTERNATE BIDS

Insert the total net amount to be added to or deducted from the Base Bid for each Alternate Item Bid by completing the appropriate section (either “Add” or “Deduct”) under each Alternate Item Bid number. The Bidder agrees that the Owner shall have the right to accept or reject any or all of the following Alternates, which acceptance or rejection shall enter into the determination of the low bidder. The Bidder acknowledges that the Contract Time shall not be increased on account of the acceptance of any one or combination of alternates.

Bidder shall enter a response to all requested Alternates. If no change in the Base Bid is required for an Alternate, enter “No Change.” If the bidder is not providing a bid for an Alternate, enter “No Bid.” If no response is provided, including entering “No Bid”, and the Owner elects to accept that Alternate, the Alternate Bid shall be treated conclusively as a bid for zero dollars for the work described, or the Bidder’s Proposal may be rejected, at the Owner’s sole discretion.

ALTERNATE No. E-1

The Contractor shall state the difference in price from the Base Bid should the Owner decide to ADD an acoustical panel ceiling system in Protective Services A109. Provide alternate lighting and controls as shown on lighting plan. Acoustical panel ceiling system to be installed by the General Contractor

ADD _____ (\$ _____)

DEDUCT _____ (\$ _____)

ALTERNATE No. E-2

The Contractor shall state the difference in price from the base bid should the Owner decide to remove the existing acoustical panel ceiling system in its entirety and furnish and install a new acoustical panel ceiling system in Exercise Science B101, Theory Classroom B103, Office B104, Theory Classroom B105, and Office B106 as indicated on the Drawings. Support existing lighting and low-voltage from structure above, after new ceiling is installed, relocate

**D-3
ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL**

and extend existing circuits to existing lighting and low-voltage in ceiling. Where drawings indicate to replace lighting, demolish lighting and controls, provide new as shown on the lighting plans. Removal of existing ceiling system and installation of new acoustical panel ceiling shall be by the General Contractor

ADD _____ (\$ _____)

DEDUCT _____ (\$ _____)

ALTERNATE No. E-3

The Contractor shall state the difference in price from the base bid should the Owner decide to select ABB/GE electrical equipment in lieu of other specified manufactures.

ADD _____ (\$ _____)

DEDUCT _____ (\$ _____)

UNIT PRICES

The undersigned agrees that the following shall constitute the unit prices for each project to be applicable to additions to or deductions from the quantities contemplated by the Contract Documents by reason of changes to the Contract Documents in the course of performance of the contemplated work:

- A. \$ _____ per duplex receptacle, installed with 100 feet of circuit and wiring in conduit.
- B. \$ _____ per data outlet, and backbox, installed with 250 feet of wiring and 20 feet of conduit.
- C. \$ _____ per ceiling mounted fire alarm audio/visual device, installed with 100 feet of wiring.
- D. \$ _____ per Lutron Vive ceiling occupancy sensor installed.
- E. \$ _____ per Lutron Vive dimming power pack installed with 30 feet of 12/2 MC cable and 0-10V dimming control cable with terminations at either end, programming included.
- F. \$ _____ per Lutron Peco wireless 3-button switch installed with raise/lower installed and programmed.
- G. \$ _____ per ceiling mounted smoke detector installed with 100 feet of wiring, programming included.
- H. \$ _____ per luminaire Type A installed with 30 feet of 12/2 MC cable.

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ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL**

- I. \$ _____ per luminaire Type E installed with 10 feet of EMT with 3 #10 conductors, 100 feet of 10/2 MC cable, terminations included.

- J. \$ _____ per 50 feet of installed 10/2 MC cable, terminations at either end of cable.

- K. \$ _____ per 20 feet of installed 1-inch conduit with 4 #10, terminations in junction boxes at either end of cable.

- L. \$ _____ per 20 feet of 1.5 inch EMT with 4 #2 conductors installed terminations in at either end of cable.

- M. \$ _____ per 480V/3P 100A fused disconnect, 3-100A fuses, installed terminations in at either end of cable.

- N. \$ _____ per 10 feet of installed two-compartment surface raceway, including one 90-degree fittings, raceway cover, devices and cover plates for 3 receptacles and 3 data jacks, 10 feet of 1-inch conduit and 10 feet of 1.25 inch conduit installed.

- O. \$ _____ per coverplate, installed a 1-gang, 2-gang or 3-gang stainless steel device coverplate where device and wiring have been removed and recessed backox is abandon in the wall.

MATERIAL ALLOWANCES

The undersigned further certifies that he has included the following "Material Allowances" in the above base bid. Unused allowances shall be returned to the Owner using the remaining quantities and their respective unit price. Unit prices will govern for quantities exceeding the following allowances:

5 additional duplex receptacles including outlet box, plate and 100' of conduit, wire (2-#12 and 1-#12 ground in 3/4" conduit) and connection to spare branch circuit protective device in a panelboard for each duplex receptacle. \$ _____
(5 x A from the unit prices above)

5 additional data outlets, including outlet box, 20' of conduit, 250' of cable, jacks, terminations, labeling and testing. \$ _____
(5 x B from the unit prices above)

4 additional ceiling mounted fire alarm audible/visual, devices, including box, 100' of plenum rated wire and connection for each fire alarm audible/visual device. \$ _____
(4 x C from the unit prices above)

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ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL**

**Interior Alterations – Phase 3
Eastern Center for Arts and Technology**

Commission Number 694

- 6 additional Lutron Vive ceiling occupancy sensors, including programming.
(6 x D from the unit prices above) \$ _____
- 3 additional Lutron dimming power packs, 30' of MC cable and control cable, terminations at either end, programming included.
(3 x E from the unit prices above) \$ _____
- 3 additional Lutron Peco wireless 3-button with raise/lower, installed and programmed.
(3 x F from the unit prices above) \$ _____
- 4 additional ceiling mounted smoke detector
With 100' of wiring, programming and installation included.
(4 x G from the unit prices above) \$ _____
- 2 additional luminaire Type A with 30' of 12/2 MC cable, terminations and installation included.
(2 x H from the unit prices above) \$ _____
- 2 additional luminaire Type E with 10' of EMT with 3 #10 conductors, 100' of 10/2 MC cable, terminations and installation included.
(2 x I from the unit prices above) \$ _____
- 5 additional 50' lengths of 10/2 MC cable, terminations and installation included.
(5 x J from the unit prices above) \$ _____
- 10 additional 20' lengths of 1" conduit with 4 #10 conductors, terminations and installation included.
(10 x K from the unit prices above) \$ _____
- 4 additional 20' lengths of 1.5" EMT with 4 #2 conductors, terminations and installation included.
(4 x L from the unit prices above) \$ _____
- 5 additional 480V/3P 100A fused disconnect, 3-100A fuses, conductor terminations and installation included.
(5 x M from the unit prices above) \$ _____
- 2 additional 10' sections of two-compartment surface raceway, including 1 90-degree fitting, raceway cover, devices and coverplates for 3 receptacles and 3 data jacks, 10' of 1" conduit and 10' of 1.25" conduit, installation included.
(2 x N from the unit prices above) \$ _____
- 100 additional 1-gang, 2-gang or 3-gang coverplates, installed on abandon in place recessed boxes in masonry walls.
(100 x O from the unit prices above) \$ _____

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ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL

The undersigned agrees that:

- (1) the Contract Documents are incorporated herein by reference and shall be construed to be part hereof, with the same effect as if such were reported at length herein, or were physically attached hereto;
- (2) this proposal is genuine and is not sham, collusive or fraudulent;
- (3) this proposal is not made in the interest or in behalf of any persons other than the undersigned;
- (4) the undersigned has not sought in any manner, by collusion or otherwise, to secure any advantage over any other bidder;
- (5) he/she will not assign his bid or any of his rights or interest thereunder without the written consent of the Owner.

SIGNATURES

When the Bidder is an Individual:

WITNESS:

Signature of Individual (SEAL)

Trading and doing business as:

Address

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ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL**

When the Bidder is a Partnership (Name of Partners):

WITNESS:

Name of Partnership

Address

BY: _____ (SEAL)
Partner

BY: _____ (SEAL)
Partner

BY: _____ (SEAL)
Partner

BY: _____ (SEAL)
Partner

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ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL**

When the Bidder is a Corporation:

ATTEST:

Name of Corporation

Address

Secretary/Assistant Secretary

BY: _____
President/Vice President

(CORPORATE SEAL)

_____ is a corporation organized and existing
under the laws of _____ and has (has not)
been granted a certificate of authority to do business in the State of Pennsylvania.

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ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL**

When the Bidder is a Limited Liability Company:

WITNESS:

Name of Limited Liability Company

BY: _____(SEAL)
(Managing) Member

BY: _____(SEAL)
Member

BY: _____(SEAL)
Member

or (if appropriate)

WITNESS:

Name of Limited Liability Company

*BY: _____(SEAL)
(Authorized Representative)

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

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ELECTRICAL CONSTRUCTION BID FORM – PROPOSAL**

BID BOND

Date _____

KNOW ALL PERSONS BY THESE PRESENTS, that we _____
_____ as Principal and _____
_____ of the City of _____
State of _____ a corporation existing under the laws of
the State of _____ and authorized to transact business in the
Commonwealth of Pennsylvania, as Surety, are held and firmly bound unto the **EASTERN
CENTER for ARTS and TECHNOLOGY** hereinafter called the Obligee, in the sum of
_____ Dollars (\$_____)
lawful money of the United States of America, for the payment of which sum well and truly to
be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and
severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted
the accompanying Proposal dated _____, 2022 for the **Interior Alterations –
Phase 3 Project** for the **Eastern Center for Arts and Technology** as set forth in the Contract
Documents.

THEREFORE, the condition of this obligation is that if said Principal shall furnish a
Performance Bond, a Labor and Material Payment Bond and insurance certificates in all
respects as required by said contract documents, within ten (10) days of the Obligee's delivery
to the Principal of Notice of Intention to award a contract to such Principal, and the Principal
shall enter into such contract within ten (10) days after issuance of Notice of Award to him,
then this obligation shall be void; but otherwise it shall remain in full force and the Principal
and Surety will pay to the Obligee the difference between the amount of the Principal's
accepted bid(s) and any higher amount for which the Obligee may contract for the required
work, plus any advertising, Architect, legal and other expenses incurred by the Obligee by
reason of the default; provided, however, that the obligations of the Surety hereunder shall not
exceed the amount of this bond together with interest.

IN WITNESS WHEREOF, the Principal and 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.

SIGNATURES

When the Bidder is an Individual:

WITNESS:

_____(SEAL)
Signature of Individual

Trading & doing business as:

Address

When the Bidder is a Partnership (Name of Partners):

WITNESS:

Name of Partnership

Address

BY: _____(SEAL)
Partner

BY: _____(SEAL)
Partner

BY: _____(SEAL)
Partner

BY: _____(SEAL)
Partner

When the Bidder is a Corporation:

ATTEST:

Name of Corporation

Address

Secretary/Assistant Secretary

BY: _____
President/Vice President

(CORPORATE SEAL)

OR (IF APPROPRIATE)

WITNESS:

Name of Corporation

Address

**BY: _____
Authorized Representative

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

(Corporation Surety)

WITNESS:

Name of Corporation

Address

**BY: _____
Attorney-in-fact

(CORPORATE SEAL)

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

NOTE: If the Contractor is a partnership, all partners should execute Bond.

When the Bidder is a Limited Liability Company:

WITNESS: _____
Name of Limited Liability Company

BY: _____ (SEAL)
(Managing) Member

BY: _____ (SEAL)
Member

BY: _____ (SEAL)
Member

or (if appropriate)

WITNESS: _____
Name of Limited Liability Company

*BY: _____ (SEAL)
(Authorized Representative)

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

AGREEMENT OF SURETY

KNOW ALL MEN BY THESE PRESENTS, that we, _____
as Surety, a corporation existing under the laws of the State of _____, and authorized to transact business in the Commonwealth of Pennsylvania hereby agree intending to be legally bound hereby, to execute and deliver to the **Eastern Center for Arts and Technology**, within the time limit specified in the Contract Documents, the Performance Bond and Labor and Material Payment Bond in the forms included in the Contract Documents each in an amount of 100% of the contract amount, in favor of the **Eastern Center for Arts and Technology**, as required for the faithful performance and proper fulfillment of the contract for the Interior Alterations – Phase 3 Project for the **Eastern Center for arts and Technology** as set forth in the Contract Documents on behalf of _____ (hereinafter called the Bidder) provided that the above contract be awarded to the Bidder within sixty (60) days after the date of opening of the bids or otherwise as set forth in the Instructions to Bidders.

DATED: _____, 20_____

(CORPORATE SURETY)

ATTEST: _____
Secretary

BY: _____
President

(CORPORATE SEAL)

AGGREEMENT OF SURETY - 1 -

LETTER OF INSURER

DATE: _____

TO: Ms. Katie Braun, Business Manager
Eastern Center for Arts and Technology
3075 Terwood Road
Willow Grove, PA 19090

Dear Ms. Braun:

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

hereby represents that if

(Insert name of Bidder)

is awarded the Contract for Construction of the Project, or that portion thereof, as is described in the Contract for Construction, then the above-named insurance company or companies will issue insurance, naming the Chester County Intermediate Unit and its Architect as additional insured, for the coverages and in the amounts required by the Contract Documents, as set forth in Article 11 of the General Conditions.

(Name of Agent)

By: _____
(Authorized Representative)

NON-COLLUSION AFFIDAVIT

Date _____

State of _____ :
 County of _____ :
 SS

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

I state that:

- (1) The price(s) and amount of this Bid have been arrived at independently and without consultation, communication or agreement with any other contractor, bidder or potential bidder.
- (2) Neither the price(s) nor the amount of this Bid, and neither the approximate price(s) nor approximate amount of this Bid, have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed before Bid opening.
- (3) No attempt has been made or will be made to induce any firm or person to refrain from bidding on this contract, or to submit a bid higher than this Bid, or to submit any intentionally high or noncompetitive bid or other form of complementary bid.
- (4) The Bid of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid.
- (5) _____, its affiliates,
 (Name of My Firm)
 subsidiaries, officers, directors and employees are not currently under investigation by any governmental agency and have not in the last three years been convicted or found liable for any act prohibited by State or Federal Law in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract except as follows:

NON-COLLUSION AFFIDAVIT – 1

I state that _____
(Name of My Firm)

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

(Name)

(Company Position)

SWORN TO AND SUBSCRIBED

BEFORE ME THIS _____ DAY

OF _____, 20____.

Notary Public

My Commission Expires

NON-COLLUSION AFFIDAVIT – 2

INSTRUCTIONS FOR NON-COLLUSION AFFIDAVIT

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

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

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

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

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

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

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

NON-COLLUSION AFFIDAVIT – 3



AIA[®] Document A305™ – 2020

Contractor's Qualification Statement

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

SUBMITTED BY: _____ **SUBMITTED TO:** _____
(Organization name and address.) (Organization name and address.)

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

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

- Exhibit A – General Information
- Exhibit B – Financial and Performance Information
- Exhibit C – Project-Specific Information
- Exhibit D – Past Project Experience
- Exhibit E – Past Project Experience (Continued)

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

Organization's Authorized Representative **Date**
Signature

Printed Name and Title

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

Notary Signature

My commission expires:

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

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

AIA[®] Document A305™ – 2020 Exhibit A

General Information

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

§ A.1 ORGANIZATION

§ A.1.1 Name and Location

§ A.1.1.1 Identify the full legal name of your organization.

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

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

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

§ A.1.2 Legal Status

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

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

ADDITIONS AND DELETIONS:

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

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

§ A.1.3 Other Information

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

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

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

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

§ A.2 EXPERIENCE

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

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

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

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

§ A.3 CAPABILITIES

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

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

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

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

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

§ A.4 REFERENCES

§ A.4.1 Identify three client references:

(Insert name, organization, and contact information)

§ A.4.2 Identify three architect references:

(Insert name, organization, and contact information)

§ A.4.3 Identify one bank reference:

(Insert name, organization, and contact information)

§ A.4.4 Identify three subcontractor or other trade references:

(Insert name, organization, and contact information)

AIA[®] Document A305[™] – 2020 Exhibit B

Financial and Performance Information

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

§ B.1 FINANCIAL

§ B.1.1 Federal tax identification number:

§ B.1.2 Has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management, been the subject of any bankruptcy proceeding within the last ten years?

§ B.1.3 Identify your organization's preferred credit rating agency and identification information.

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

(Paragraphs deleted)

§ B.2 DISPUTES AND DISCIPLINARY ACTIONS

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

(If the answer is yes, provide an explanation.)

§ B.2.2 In the last five years has your organization, its parent, or a subsidiary, affiliate, or other entity having common ownership or management:

(If the answer to any of the questions below is yes, provide an explanation.)

- .1 failed to complete work awarded to it?
- .2 been terminated for any reason except for an owners' convenience?
- .3 had any judgments, settlements, or awards pertaining to a construction project in which your

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organization was responsible for more than \$75,000?

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

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

- .1 been convicted of, or indicted for, a business-related crime?
- .2 had any business or professional license subjected to disciplinary action?
- .3 been penalized or fined by a state or federal environmental agency?

AIA[®] Document A305™ – 2020 Exhibit C

Project Specific Information

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

PROJECT:

(Name and location or address.)

CONTRACTOR'S PROJECT OFFICE:

(Identify the office out of which the contractor proposes to perform the work for the Project.)

TYPE OF WORK SOUGHT

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

CONFLICT OF INTEREST

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

§ C.1 PERFORMANCE OF THE WORK

§ C.1.1 When was the Contractor's Project Office established?

§ C.1.2

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

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

ADDITIONS AND DELETIONS:

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

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

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

§ C.2 EXPERIENCE RELATED TO THE PROJECT

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

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

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

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

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

§ C.3 SAFETY PROGRAM AND RECORD

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

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

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

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

§ C.4 INSURANCE

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

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

§ C.4.3 Does your commercial general liability policy contain any exclusions or restrictions of coverage that are prohibited in AIA Document A101-2017, Exhibit A, Insurance A.3.2.2.3? If so, identify.

§ C.5 SURETY

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

§ C.5.2 Surety company name:

§ C.5.3 Surety agent name and contact information:

§ C.5.4 Total bonding capacity:

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



AIA[®] Document A305[™] – 2020 Exhibit D

Contractor's Past Project Experience

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



AIA[®] Document A305™ – 2020 Exhibit E

Contractor's Past Project Experience, Continued

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

ADDENDUM TO CONTRACTOR’S QUALIFICATION STATEMENT

Article A.2 Experience – Add Paragraphs A.2.5 thru A.2.8 Follows:

A.2.5 For each project listed in your response to Exhibit D, state the name, business address and business telephone number of: (a) the Owner’s Project representative or principal contact; and (b) the Architect’s Project representative or principal contact.

A.2.6 On a separate sheet, list the last fifteen (15) construction projects (regardless of contract amount) on which your organization has most recently commenced construction work or services, giving the name of the project, Owner, Architect, contract amount, date of commencement of the work, date of completion of the work and percentage of the work performed with your own forces. In addition, for each project listed state the name, business address and business telephone number of: (a) the Owner’s Project representative or principal contact; and (b) the Architect’s Project representative or principal contact.

A.2.7 Neither the Bidder nor any general or limited partner, officer, director or shareholder of the Bidder has, at any time within three years of the date of the bid, been: (1) suspended or debarred by any governmental entity or agency, whether state or federal; or (2) convicted or found liable for any act prohibited by federal or state law in any jurisdiction involving conspiracy or collusion with respect to bidding on any public contract, except as follows: _____

(Attach additional sheet if necessary)

Note: Any such conviction shall not prohibit the Owner from awarding the contract to the Bidder, but may be grounds for a determination by the Owner that the bid should be rejected because the Bidder is not responsible.

A.2.8 The Bidder has not conspired, colluded or combined with any other person or entity in order to commit or attempt to commit bid-rigging involving this bid.

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

Name:
Title:

Subscribed and sworn to before me
this _____ day of _____, 202____.

Notary Public

My commission expires:

ADDENDUM TO CONTRACTOR’S QUALIFICATION STATEMENT

AGREEMENT BETWEEN OWNER AND CONTRACTOR

THIS AGREEMENT made the _____ day of _____ in the year Two Thousand _____ (20__) by and between the **Eastern Center for Arts and Technology, Willow Grove, Montgomery County, Pennsylvania**, hereinafter called the Owner, and _____, hereinafter called the Contractor, and hereinafter treated as if of the singular number and neuter gender.

WHEREAS, the Owner has advertised for proposals as required by law for the _____ Construction of the **Interior Alterations – Phase 3 Project** as set forth in the Contract Documents and has awarded a contract to the Contractor, who was the lowest responsible Bidder meeting all Bid Requirements; and,

WHEREAS, the Contractor has furnished Labor and Material Payment and Performance Bonds to the Owner with sufficient surety in the sum determined upon by the Owner and set forth in the Bid Documents conditioned for the faithful performance of the terms of this contract.

NOW, therefore, this agreement witnesseth, that for, and in consideration of the mutual promises, covenants, and agreements by each of the parties hereto the other made, and each party intending to be legally bound hereby, the parties hereto do covenant, promise and agree as follows:

FIRST: The Contract Documents, which consist of: the Agreement Between Owner and Contractor, Instructions to Bidders, Form of Proposal, Bid Bond, Contractor's Qualification Statement, General Conditions of the Contract, Performance Bond, Labor and Material Payment Bond, the Drawings, the Plans, the Specifications, all addenda issued prior to execution of the Agreement, all accepted alternates and all modifications thereto, and forms referred to therein and collectively called the "Contract Documents", herein, are hereby incorporated into and made a part of the contract to the same extent as if they were herein fully set forth.

SECOND: Contractor agrees to furnish the labor, material, tools, machinery, equipment, facilities, supplies, light, heat, power, tests and transportation to do all things necessary for the construction and completion of the work; to secure all permits and licenses, to furnish efficient business administration and superintendence; to have at the work whenever needed and to keep them upon it at all times, an adequate supply of workmen and materials, and to secure its execution in the best, most workmanlike, expeditious and economical manner.

The Contractor, recognizing the relations of trust and confidence established between himself and the Owner by the terms of this agreement, undertakes to furnish his best skill and judgment and to cooperate loyally with the Architect in forwarding the interests of the Owner, and to have no pecuniary interest, direct, or indirect, in the contract, or in its performance other than as disclosed in this Agreement.

THIRD: Contractor further covenants and agrees that all said work and labor shall be done and performed in the best and most workmanlike manner and that all and every of said materials and labor shall be in strict and entire conformity, in every respect, with said plans and specifications, and shall be subject to the approval of the Owner, or BRESLIN RIDYARD FADERO ARCHITECTS, and in case any of said material or labor shall be rejected by said Owner or BRESLIN RIDYARD FADERO ARCHITECTS, as defective or unsuitable, then said materials shall be removed and replaced with other approved materials and the said labor shall be done anew to the satisfaction and approval of the said Owner or its agents, at the cost and expense of the Contractor.

FOURTH: Contractor agrees that time is of the essence in regard to the schedule and agrees to begin all the work under the contract within ten (10) calendar days following receipt of a "Notice to Proceed" and to Substantially Complete the same to the satisfaction and approval in every respect, of the aforesaid Owner, in accordance with the schedule given in the "Form of Proposal" and Section 011100 "Summary of Work." Contractor further agrees that if he/she shall fail to Substantially Complete the work in accordance with said schedule or such duly signed extensions thereof as shall be granted in accordance with the conditions of this contract, herein mentioned and made a part of this Contract, then the Contractor shall pay to the Owner or agrees to a deduction from any funds due said Contractor from said Owner, not as a penalty but as liquidated damages, the sum of One Thousand Dollard (\$1,000.00) per calendar day for each and every calendar day thereafter for each phase until such work shall be Substantially Completed and accepted by the Owner:

Additionally the Owner shall be entitled to a fixed sum of One Hundred Dollars (\$100.00) liquidated damages for each and every calendar day that the full completion of the project including the List of Deficiencies (Punch List) is not achieved commencing the thirtieth (30th) calendar day after Substantial Completion until full completion is achieved.

Substantial Completion shall be defined as the date certified by the Architect when the construction is sufficiently complete, in accordance with the Contract Documents, so that the Owner may occupy or utilize the work or designated portion thereof for the use for which it is intended, as expressed in the Contract Documents (as defined by Act No. 1978-317 of the General Assembly of the Commonwealth of Pennsylvania).

Provided, however, that if the Substantial Completion of this contract is delayed by conditions defined in Article 8 of the General Conditions of the Contract, then and in such event the time of substantial completion of this contract shall be extended for such additional time as shall be caused by such delay.

Provided, however, that the Contractor herein shall within 10 days of such delay, if any, request from the Architect in writing such additional time within which to complete the performance of this contract.

FIFTH: The Contractor will not at any time suffer or permit any lien, attachment, or other encumbrance, under any laws of the state or otherwise, by any person or persons whomsoever, to be entered against or remain upon the premises, into or upon which any work is done or by reason of any other claim or demand against the Contractor, and that he/she will not put any materials on said site to which he/she has not obtained absolute title; and that any such lien, attachment, or other encumbrance, or claims of a third party, until it is removed, shall preclude any and all claims or demand for any payment whatever under or by virtue of this contract, and in the event that same is not removed, the Owner may remove the same at the expense, including legal fees, of the Contractor.

**F-2
AGREEMENT BETWEEN OWNER AND CONTRACTOR**

SIXTH: Contractor covenants and agrees to remedy, without cost to the Owner, any defects which may develop within one (1) year from the date of Substantial Completion of the Contract, for the work performed under this contract, provided said defects in the judgment of said Owner, or its successors having jurisdiction in the premises, are caused by defective or inferior materials and workmanship; and the Performance Bond hereto attached and made a part hereof, shall provide a guarantee in the sum of one hundred percentum (100%) of the total contract price of the work done, for the correction and remedy of such defect. When indicated in the Contract Documents the warranty period shall be extended beyond the one year period.

SEVENTH: No modification or changes of this Contract shall be made except in accordance with Article 12 of the General Conditions.

EIGHTH: The Owner agrees, in consideration of the completion by Contractor of the work contemplated in this Contract in strict accordance therewith to the satisfaction and acceptance of the Owner, to pay to the Contractor the sum of

Dollars (\$) _____)

payment to be made as set forth in the General Conditions of the Contract, provided, however, that deductions from or additions to said sum to be paid will be made upon the basis set forth in the General Conditions of the Contract. It is agreed that, if by any reason of alteration in the plans or in the character of the work to be performed under the Contract, the quantity of the work to be performed shall be increased or decreased, additions to or deductions from the Contract Price above mentioned shall be made in accordance with the accepted Unit Price, if any, agreed to in writing by the Owner, and further that Contractor will make no claims for loss of anticipated profits if the quantities of any items or work actually ordered to be done shall be less than those set forth in the Specifications or if any item or items set forth in the Specifications be entirely omitted.

Monthly, the Contractor may request payment for work completed. The monthly request for payment on this contract shall be prepared for work completed to the 25th calendar day of each month. Monthly requests for payment must be received in the office of the Architect by the 1st calendar day of the following month. Retainage shall be as defined in Article 9 of the General Conditions of the Contract.

Contractor acknowledges the current circumstances and the limitations imposed upon the construction industry as a result of COVID-19 pandemic. In the event of any delay in the performance of the Contract due directly to the current circumstances of the pandemic, Contractor agrees to fully perform its services under this Contract at the agreed upon Contract Sum as set forth and as modified in this Section and elsewhere in the Contract Documents, without an increase in the Contract Sum. Except for new government regulations, requirements, or guidance for which the Contractor may also be entitled to monetary relief, Contractor's sole remedy for any such delay in performance due to the current circumstances of the pandemic shall be an extension of the Contract Time which shall be agreed upon by Change Order.

NINTH: This Contract shall be binding on the parties hereto, their heirs, executors, administrators, successors and assigns.

TENTH: There shall be no changes or alterations from the original Plans, Specifications, or Contract Documents, except in accordance with Article 12 of the General Conditions.

**F-3
AGREEMENT BETWEEN OWNER AND CONTRACTOR**

ELEVENTH: Terms used in this Agreement which are defined in the General Conditions of the Contract shall have the meanings designated in those conditions. The Contract Documents which constitute the entire agreement between Owner and the Contractor, except for modifications issued after execution of this agreement, are enumerated as follows:

TWELVETH: Safety: Without limiting any other provisions regarding safety in the Contract Documents or under law, the Contractor shall take reasonable precautions for the safety of, and shall provide reasonable protection to prevent damage, injury or loss to employees on the Work and other persons who may be affected thereby, and the Work and materials and equipment to be incorporated therein, with respect to the Work.

The Contractor shall comply with all applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons and property and their protection from damage, injury or loss, specifically including all measures necessary and as may be required to comply with the Guidance and Directives from the Commonwealth of Pennsylvania, the Centers for Disease Control and Prevention (CDC), and any other governmental agency, relating to and arising from the COVID-19 pandemic. The Contractor agrees to comply with the Guidance for Construction Industry issued by Governor Tom Wolfe on April 23, 2020.

(List below the Agreement Between Owner and Contractor, Instructions to Bidders, Form of Proposal, Bid Bond, Agreement of Surety, Contractor's Qualification Statement, General Conditions of the Contract, Performance Bond, Labor and Material Payment Bond, Certificates of Insurance, the Drawings, the Plans, the Specifications, all addenda issued prior to execution of the Agreement, all accepted alternates and all modifications thereto)

OWNER: EASTERN CENTER FOR ARTS AND TECHNOLOGY
WILLOW GROVE, MONTGOMERY COUNTY, PA

(SEAL)

BY: _____

ATTEST:

NAME: _____
(please type)

TITLE: _____

NAME: _____
(please type)

TITLE: _____

CONTRACTOR
(individual)

WITNESS:

_____ (SEAL)
(signature of individual)

Trading and doing business as:

Address

**F-5
AGREEMENT BETWEEN OWNER AND CONTRACTOR**

PARTNERSHIP

WITNESS:

(Name of Partnership)

Address

BY: _____ (SEAL)
Partner

BY: _____ (SEAL)
Partner

BY: _____ (SEAL)
Partner

BY: _____ (SEAL)
Partner

CORPORATION

(name of corporation)

Address

BY: _____
President/Vice President

ATTEST:

NAME: _____
(please type)

**F-6
AGREEMENT BETWEEN OWNER AND CONTRACTOR**

Secretary/Assistant Secretary

NAME: _____
(please type)

(CORPORATE SEAL)

OR (IF APPROPRIATE)

WITNESS: _____
(name of corporation)

_____ *BY: _____
(authorized representative)

NAME: _____
(please type)

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

**F-7
AGREEMENT BETWEEN OWNER AND CONTRACTOR**

When the Bidder is a Limited Liability Company:

WITNESS:

Name of Limited Liability Company

BY: _____ (SEAL)
(Managing) Member

BY: _____ (SEAL)
Member

BY: _____ (SEAL)
Member

or (if appropriate)

WITNESS:

Name of Limited Liability Company

*BY: _____ (SEAL)
(Authorized Representative)

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

**F-8
AGREEMENT BETWEEN OWNER AND CONTRACTOR**

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Principal (the “Principal”), and _____, a corporation organized and existing under the laws of the _____ of _____, having its principal office at _____, and authorized to do business in the Commonwealth of Pennsylvania, as Surety (the “Surety”), are held and firmly bound, jointly and severally, unto the **Eastern Center for Arts and Technology**, Montgomery County, Pennsylvania, as Obligee (the “Obligee”), as hereinafter set forth in the full and just sum of _____ Dollars (\$_____), lawful money of the United States of America, for the payment of which sum we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents. If more than one surety is named above, said sureties shall be jointly and severally liable to Obligee.

WITNESSETH THAT:

WHEREAS, The Principal heretofore has submitted to the Obligee a certain bid, dated _____ 20____ (the “Bid”), to perform certain _____ Construction work for the Obligee, in connection with the **Interior Alterations – Phase 3 Project** located on Terwood Road in Willow Grove, Montgomery County, Pennsylvania pursuant to Drawings, Specifications and other related documents, constituting the contract documents, which are incorporated into the Bid by reference and a part thereof (the “Contract Documents”), as prepared by Breslin Ridyard Fadero Architects; and

WHEREAS, the Contract Documents are incorporated in this Bond by reference and made a part hereof; and

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

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

**G-1
PERFORMANCE BOND**

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

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

NOW, THEREFORE, the terms and conditions of this bond are and shall be that if: (a) the Principal well, truly and faithfully shall comply with and shall perform the Agreement in accordance with the Contract Documents, at the time and in the manner provided in the Agreement and in the Contract Documents, and if the Principal shall satisfy all claims and demands incurred in or related to the performance of the Agreement by the Principal or growing out of the performance of the Agreement by the Principal, and if the Principal shall indemnify completely and shall save harmless the Obligee and all of its officers, agents and employees from any and all costs and damages which the Obligee and all of its officers, agents and employees may sustain or suffer by reason of the failure of the Principal to do so, and if the Principal shall reimburse completely and shall pay to the Obligee any and all costs and expenses which the Obligee and all of its officers, agents and employees may incur by reason of any such default or failure of the Principal, including, but not limited to, additional legal and professional fees resulting from such default or failure of the Principal, delay damages resulting from such default or failure of the Principal, and liquidated damages in accordance with the Contract Documents; and (b) if the Principal shall remedy, without cost to the Obligee, all defects which may develop during the period of one (1) year from the Date of Substantial Completion by the Principal and acceptance of the Obligee of the work to be performed under the Agreement in accordance with the Contract Documents, which defects, in the sole judgment of the Obligee or its legal successors in interests, shall be caused by or shall result from defective or inferior materials or workmanship, then this Bond shall be void; otherwise, this Bond shall be and shall remain in force and effect and all claims, demands, costs, expenses and damages including, but not limited to, additional legal and professional fees resulting from the default or failure of Principal, delay damages resulting from such default or failure of the Principal, and liquidated damages in accordance with the Contract Documents, shall be payable by Principal and Surety to Owner; provided, however, that the obligations of the Surety hereunder shall not exceed the amount of this Performance Bond.

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

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

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PERFORMANCE BOND**

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

Any dispute resolution proceeding, legal or equitable, under this Bond shall be instituted in the Court of Common Pleas of Montgomery County, or at Obligee’s election by mediation or arbitration pursuant to the Contract Documents, and in any such dispute resolution proceeding Obligee may join both Principal and Surety as parties, and Principal and Surety hereby consent to such joinder, jurisdiction and venue. This Bond shall be governed by, and construed and enforced in accordance with, the laws of the Commonwealth of Pennsylvania.

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

(Individual Principal)

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

* * * * *

(Partnership Principal)

WITNESS: _____ (Name of Partnership)
By: _____ (SEAL)
Partner
By: _____ (SEAL)
Partner
By: _____ (SEAL)
Partner

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PERFORMANCE BOND**

(Corporate Principal)

ATTEST:

(Name of Corporation)

Secretary (Assistant Secretary)

By: _____ (SEAL)
President (Vice President)

(CORPORATE SEAL)

or (if appropriate)

WITNESS:

(Name of Corporation)

*By: _____
(Authorized Representative)

*Attach appropriate proof, with raised corporate seal, dated as of the same date as the Bond, evidencing authority to execute on behalf of the corporation.

(Limited Liability Company)

WITNESS:

(Name of Limited Liability Company)

By: _____ (SEAL)
(Managing) Member

By: _____ (SEAL)
Member

By: _____ (SEAL)
Member

or (if appropriate)

WITNESS:

(Name of Limited Liability Company)

*By: _____
(Authorized Representative)

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

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PERFORMANCE BOND**

* * * * *

(Corporate Surety)

WITNESS:

(Name of Corporation)

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

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

**G-5
PERFORMANCE BOND**

LABOR AND MATERIAL PAYMENT BOND

Bond No.: _____

KNOW ALL PERSONS BY THESE PRESENTS, that _____

_____, a _____ corporation,
(Name of Contractor)

of _____, as
(Address of Contractor)

Principal (hereinafter called the "Principal"), and _____

_____, a _____ corporation,
(Name of Surety)

of _____, as
(Address of Surety)

Surety (hereinafter called the "Surety"), are held and firmly bound unto the **Eastern Center for Arts and Technology**, Montgomery County, Pennsylvania (hereinafter called the "Obligee"), in the sum of _____ DOLLARS (\$ _____), for the payment of which sum well and truly to be made, the Principal and Surety bind themselves, and their respective heirs, administrators, executors, successors and assigns jointly and severally, firmly by these presents.

WHEREAS, the Principal and the Obligee have entered into a written Contract for Construction dated _____ (hereinafter called the "Contract"), for the _____ Construction of the **Interior Alterations – Phase 3 Project** located on Terwood Road in Willow Grove, Montgomery County, Pennsylvania, or that portion thereof, as is described therein, all as more fully described and mentioned in said Contract and the Contract Documents identified therein, which are hereby incorporated in and made a part of this Bond with the same force and effect as if fully set forth at length herein; and

WHEREAS, Obligee is a "contracting body" under the provisions of Act No. 385 of the General Assembly of the Commonwealth of Pennsylvania, approved by the Governor on December 20, 1967, known and cited as the "Public Works Contractors Bond Law of 1967," 8 P.S. §191 et seq. (the "Act"); and

WHEREAS, the Act requires that before an award shall be made to the Principal by the Obligee, the Principal shall furnish this Labor and Material Payment Bond to the Obligee; and

WHEREAS, the Contract and the Contract Documents identified therein also require the Principal to furnish this Labor and Material Payment Bond to the Obligee.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall promptly make payment to all claimants, as hereinafter defined, for all material furnished and labor supplied or performed, including public utility services and reasonable rentals of equipment (but only for periods when the equipment rented is actually used at the site), then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. This Bond shall be solely for the protection of claimants supplying labor or materials in the prosecution of the Work provided for in the Contract to the Principal. A Claimant is defined as a person, co-partnership, association or corporation who has furnished material or supplied or performed labor in the prosecution of the Work under the Contract, including public utility services and reasonable rentals of equipment (but only for periods when the equipment rented is actually used at the site).

2. The above-named Principal and Surety hereby jointly and severally agree with the Obligee that every claimant, as herein defined, who has performed labor or furnished material in the prosecution of the Work under the Contract and who has not been paid in full therefor before the expiration of ninety (90) days after the day on which such claimant performed the last of such labor or furnished the last of such materials for which it claims payment, may bring an action on this Bond in its own name, in assumpsit to recover any amount due it for such labor or material and may prosecute such action to final judgment and have execution on the judgment. The provisions of this Bond shall be applicable whether or not the material furnished or the labor performed enters into and becomes a component part of the public building, public work or public improvement contemplated by the Contract. The Obligee shall not be liable for the payment of any costs or expenses of any such suit.

3. No suit or action shall be commenced hereunder by any claimant:

(a) if the claimant has a direct contractual relationship with any Subcontractor of the Principal, but has no contractual relationship, express or implied, with the Principal, unless such claimant shall have given written notice to the Principal within ninety (90) days after such claimant did or performed the last of the Work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the Work or labor was done or performed. Such notice shall be served by mailing same registered mail or certified mail, postage prepaid, in an envelope addressed to the Principal at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the manner now or hereafter provided by law for the service of a summons, except that such service need not be made by a public officer;

(b) after the expiration of one (1) year following the date on which Principal ceased work on said Contract; it being understood, however, that if any limitation embodied in this Bond is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law;

(c) other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the Project, or any part thereof, is situated, or in the United States District Court for the district in which the Project, or any part thereof, is situated, and not elsewhere.

4. The amount of this Bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder by Surety.

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LABOR AND MATERIAL PAYMENT BOND**

IN WITNESS WHEREOF, the Principal and Surety have hereunto caused this Bond to be duly executed and acknowledged as set forth below this _____ day of _____, 20__.

(Corporate Seal) _____
(Name of Principal)

Attest: _____
By: _____

(Secretary/Assistant Secretary) Title: _____

(Corporate Seal) _____
(Name of Surety)

Attest: _____
By: _____

(Secretary) Title: _____
Attorney-in-Fact

NOTE: An original Power of Attorney bearing same date as Bond must be attached.

CORPORATE ACKNOWLEDGMENT

STATE OF _____ :
 : ss.
COUNTY OF _____ :

On this _____ day of _____, 20____, before me appeared _____, to me known, who being by me duly sworn, did depose and say that (s)he resided in _____; that (s)he is the _____ of _____, the corporation (Principal) described in and which executed the foregoing Labor and Material Payment Bond (hereinafter "Bond"); that (s)he knew the seal of said corporation; that the seal affixed to the foregoing Bond is the corporate seal of said corporation; and that the foregoing Bond was signed, sealed and delivered on behalf of said corporation by its authority duly given as the voluntary act and deed of said corporation.

IN WITNESS WHEREOF, the said _____ has subscribed and sworn to the foregoing oaths before me, and I have hereunto set my hand and affixed my official seal the day and year first above written.

NOTARY PUBLIC

(Seal)
My Commission Expires:

GENERAL CONDITIONS OF THE CONTRACT

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ARTICLE 1

CONTRACT DOCUMENTS

1.1 DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

1.1.1.1 The Contract Documents consist of the Agreement Between Owner and Contractor (“Agreement”), Advertisement for Bids, Instructions to Bidders, Bid Form – Proposal, Bid Bond, Agreement of Surety, Contractor’s Qualification Statement, Non-Collusion Affidavit, General Conditions of the Contract, Performance Bond, Labor and Material Payment Bond, Certificates of Insurance, the Drawings, the Specifications, all addenda issued prior to execution of the Agreement, all accepted alternates, and all modifications issued after the execution of the Agreement.

1.1.1.2 A modification is (i) a written amendment to the Contract signed by both parties, (ii) a Change Order, (iii) a Construction Change Directive, or (iv) a written order for a minor change in the Work issued by the Architect.

1.1.2 THE CONTRACT

1.1.2.1 The Contract Documents form the Contract. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a modification as defined above. Except as provided in Subparagraph 6.2.7, the Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Architect or the Architect’s Consultant, (2) between the Owner and a Subcontractor or said Sub-subcontractor, (3) between the Owner and the Architect or the Architect’s Consultant, or (4) between any persons or entities other than the Owner and Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect’s duties.

1.1.3 THE WORK

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

1.1.3.2 The Work shall include, without limitation, the obligation of the Contractor to visit the Project site before submitting a Bid. Such site visit shall be for the purpose of familiarizing the Contractor with the conditions

GENERAL CONDITIONS OF THE CONTRACT - 1

1.1.4 THE PROJECT

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

1.1.5 THE DRAWINGS

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

1.1.6 THE SPECIFICATIONS

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

1.2 CORRELATION, INTENT AND INTERPRETATIONS

1.2.1 By executing the Contract the Contractor represents that he has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract Documents.

1.2.2 The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all. The intention of the Documents is to include all labor, materials, equipment and other items as provided in Subparagraph 4.3.1 necessary for the proper execution and completion of the Work. Performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results. Words, which have well-known technical or trade meanings are used herein in accordance with such, recognized meanings.

1.2.3 All work that may be called for in the Specifications and not shown on the drawings or shown on the drawings and not called for in the Specifications, is to be provided by the Contractor as if described in both. Should any incidental work or materials be required but not set forth in the specifications or drawings, either directly or indirectly, but is, nevertheless, necessary for the proper carrying out of the intent thereof, the Contractor is to understand same to be implied and required and he shall perform all such work and furnish all such materials as fully as if they were particularly delineated or described.

1.2.3.1 Dimensions given on the drawings govern scale measurements and large-scale drawings govern small-scale drawings, except as to anything omitted unless such omission is expressly noted on the larger scale drawings. Scaling of drawings is done at the Contractor's own risk.

1.2.3.2 Should the Drawings, Schedules or Specifications disagree in themselves or with either or both of the others the better quality or greater quantity and cost of work or materials shall be estimated upon and, unless otherwise directed in writing by the Architect, shall be performed and provided.

GENERAL CONDITIONS OF THE CONTRACT - 2

1.2.4 The organization of the Specifications into divisions, sections and articles, and the arrangement of drawings shall not control the Contractor in dividing the work among Subcontractors or in establishing the extent of the work to be performed by any trade.

1.2.5 Written interpretations necessary for the proper execution or progress of the work, in the form of drawings or otherwise will be issued with reasonable promptness by the Architect and in accordance with any schedule agreed upon. Either party to the contract may make written request to the Architect for such interpretations. Such interpretations shall be consistent with and reasonably inferable from the Contract Documents, and may be affected by Architect's Supplemental Instructions.

1.2.5.1 Requests for Interpretation/Information (RFI) shall be made to the Architect with a copy to the Owner's Representative simultaneously, using the RFI form, a copy of which is included in the specifications (Exhibit "C"). The Contractor shall not submit any other RFI form.

1.2.6 The Contractor shall compensate the Owner for additional contract administration costs of the Architect for responses to the Contractor's requests for information where such information is available to the Contractor for a careful study and comparison of the Contract Documents, field conditions, and other Owner-provided information. Such compensation will be in the form of a Change Directive.

1.3 **COPIES FURNISHED**

1.3.1 Unless otherwise indicated the Owner shall furnish, free of charge, to the Contractor copies of the Contract Documents as follows:

Contract No.1 – General Construction Contract: 4 sets
Contract No.2 – HVAC Construction Contract: 2 sets
Contract No.3 – Electrical Construction Contract: 2 sets

1.3.2 Should a Contractor require a greater number of drawings than provided above, they may request additional sets, individual sheets from the Architect and pay the cost involved. The Successful Prime Contractor may retain his set of Drawings and Specifications from the bidding period and still receive any applicable plan deposit refund in accordance with the Notice To Contractors.

1.3.3 All Drawings, Specifications and copies thereof, furnished by the Architect are and shall remain his property. They are not to be used on any other project, and with the exception of one contract set for each party to the contract, are to be returned to the Architect on request at the completion of the work.

ARTICLE 2

ARCHITECT

2.1 **DEFINITION**

2.1.1 The Architect is the person or organization retained by the Owner and lawfully licensed to practice architecture in the jurisdiction where the Project is located and identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term Architect means the Architect or his authorized representative.

GENERAL CONDITIONS OF THE CONTRACT - 3

2.1.2 Duties, Responsibilities and Limitations of Authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner.

2.2 ADMINISTRATION OF THE CONTRACT

2.2.1 The Architect will provide general Administration of the Contract, including performance of the functions hereinafter described.

2.2.2 The Architect shall be a representative of and shall advise and consult with the Owner. The Architect will have authority to act on behalf of the Owner to the extent provided in the Contract Documents. All of the Owner's instructions to the Contractor shall be issued through the Architect.

2.2.3 The Architect shall at all times have access to the Work wherever it is in preparation and progress. The Contractor shall provide facilities for such access so the Architect may perform his functions under the Contract Documents.

2.2.4 The Architect will make periodic visits to the site at appropriate intervals to familiarize himself generally with the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents. On the basis of his on-site observations as an Architect, he will keep the Owner informed of the progress and quality of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work of the Contractor. The Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, and he will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Document.

2.2.5 The Architect will, in the first instance, interpret and decide matters concerning the requirements of the Contract Documents and performance thereunder by both the Owner and Contractor. The Architect will, within a reasonable time, render such interpretations as may be requested by either party regarding matters concerning performance under, and requirements of, the Contract Documents.

2.2.6 Claims, disputes and other matters in question, between the Contractor and the Owner relating to the execution or progress of the Work or the interpretation of the Contract Documents shall be referred initially to the Architect for decision, which he will render in writing within a reasonable time.

2.2.7 All interpretations and decisions of the Architect shall be consistent with the intent of the Contract Documents and will be in writing or in the form of Drawings. In regard to Architect's interpretations and decisions, he will exercise his best efforts to insure faithful performance by both the Owner and the Contractor, will not show partiality to either end, in absence of negligence, will not be liable for results of interpretations or decisions so rendered in good faith.

2.2.8 The Architect's decision in matters relating to aesthetic effect will be final if consistent with the intent of the Contract Documents.

GENERAL CONDITIONS OF THE CONTRACT - 4

2.2.9 The Architect will have authority to reject Work that does not conform to the Contract Documents. Whenever, in his reasonable opinion, he considers it necessary or advisable to insure the proper implementation of the intent of the Contract Documents, he will have authority to require special inspection or testing of the Work in accordance with Subparagraph 7.7.2 whether or not such Work be then fabricated, installed or completed. However, neither the Architect's authority to act under this Subparagraph 2.2.9, nor any decision made by him in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the Architect and/or Owner to the Contractor, any Subcontractor, any of their agents or employees, or any other person performing any of the Work.

2.2.10 The Architect will prepare Change Orders and Construction Change Directives in accordance with Article 12, and will have authority to order minor changes in the Work as provided in Article 12. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions.

2.2.11 The Architect will conduct inspections to determine the dates of Substantial Completion and Final Completion, will receive and review written warranties and related documents required by the Contract and assembled by the Contractor, and will forward such documents to the Owner, for the Owner's review and records.

2.2.12 The Architect will not be responsible for the acts or omissions of the Contractor, any Subcontractors, or any of their agents or employees, or any other persons performing any of the Work.

2.2.13 The Architect will not be responsible to expedite the job for any Contractor.

2.2.14 If the Architect shall, at any time be of the opinion that the Contractor is not progressing with the Work as rapidly as necessary to insure its completion by the date set forth in the contract; or is neglecting to remedy any defects or deficiencies; or is neglecting to repair damage to public or private property; or continues to employ or re-employ negligent or careless persons; or is conducting the Work in a manner disapproved by the Architect; or is failing to prosecute the Work in accordance with the provisions of the contract; or is violating any of the provisions of the contract; the Architect shall give the Contractor written notice of the specific deficiencies and direct the Contractor to remedy the same.

2.2.15 If, at the end of three (3) days from the date of issuance of the notice pursuant to subparagraph 2.2.14, the Contractor shall have failed to comply therewith, then the Owner may withhold all payments until the provisions of such notice are carried out, or the Owner may declare the Contractor in default.

ARTICLE 3

OWNER

3.1 DEFINITION

3.1.1 The Owner is the person or organization identified as such in the agreement and is referred to throughout the Contract Documents as if singular in number and masculine in gender. The term Owner means the Owner or his authorized representative.

3.1.2 The term "Owner" in every case shall be the **Eastern Center for Arts and Technology**.

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3.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

3.2.1 The Owner shall furnish all surveys describing the physical characteristics, easements, rights-of-way, and utility locations for the site of the Project and a legal description of the site.

3.2.2 The Owner shall issue all instructions to the Contractor through the Architect.

3.3 OWNER'S RIGHT TO STOP THE WORK

3.3.1 If the Contractor fails to correct defective work or fails to supply labor, materials or equipment in accordance with the Contract Documents, the Owner may issue a written order the Contractor to stop the work, or any portion thereof, until the cause of such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

3.4 OWNER'S RIGHT TO CARRY OUT THE WORK

3.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents or fails to perform any provision of the contract, or fails to correct work as set forth in Article 13, the Owner may, after three days written notice to the Contractor and without prejudice to any other remedy he may have, make good such deficiencies. In such case, a cost accounting shall be issued deducting from payments then or thereafter due the Contractor for the cost of correcting such deficiencies, including Owner's expenses and the cost of the Architect's additional services made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor and the surety shall be liable for and shall pay the difference to the Owner.

3.5 OWNER'S CONSTRUCTION REPRESENTATIVE

3.5.1 The Owner will engage a Construction Representative to observe the work of the Contractors. The Owner's Construction Representative will attend and participate in all progress meetings with the Contractors and Architect. The Owner's Construction Representative shall observe the work of the Contractors and report any defects or discrepancies in the work to the Owner and the Architect. Nothing herein shall create a contractual relationship between the Owner's Construction Representative and any Contractor, Subcontractor, or Sub-Subcontractor. The Owner's engagement of a Construction Representative shall not relieve the Contractor of any of its responsibilities or obligations under the Contract Documents.

ARTICLE 4

CONTRACTOR

4.1 DEFINITION

4.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required by applicable laws in the jurisdiction where the Project is

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located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term “Contractor” means the Contractor or Contractor’s authorized representative.

4.2. **SUPERVISION AND CONSTRUCTION PROCEDURES**

4.2.1 The Contractor shall supervise and direct the Work, using the Contractor’s best skill and attention. He shall be solely responsible for, and have control over, all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract.

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

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

4.2.4 Prior to proceeding with any Work, the Contractor shall:

- (a) review, compare, and analyze the Contract Documents and any information or surveys provided by the Owner; and
- (b) inspect and check such portion of the Work for proper fitting and matching with contiguous work and for proper coordination with other Work and the work of the Owner or of separate contractors; and
- (c) verify all dimensions and measurements with actual field conditions at the Project.

The Contractor shall immediately notify the Owner and the Architect of any errors, omissions, or inconsistencies noted as the result of the Contractor’s activities under subparagraphs (a), (b), and (c) above. If the Contractor knows or reasonably should know of any such error, omission, or inconsistency and proceeds with the construction in question without first giving such notice, any claim for an adjustment to the Contract Sum or the Contract Time shall be deemed waived and released and the Contractor and its Surety shall assume all responsibility and liability for such performance and shall indemnify the Owner for all costs, expenses, losses, and/or damages incurred by Owner, including Architects’ and attorneys’ fees and expenses, incurred by the Owner as a result thereof, including any cost to repair, correct, or re-work the construction in question.

4.3 **LABOR AND MATERIALS**

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

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

4.3.3 Owner specifically reserves the right to reject any person Owner deems unfit to be permitted on school grounds and in proximity to students. Upon written notice from Owner, Contractor shall have all such persons removed from the Project. Owner's right to declare such persons unfit shall not be limited to the required exclusion of persons from school property as set forth in Section 1-111 of the Pennsylvania Public School Code or Section 6355 of the Child Protective Services Law.

4.4 **WARRANTY**

4.4.1 The Contractor shall warrant to the Owner and Architect that all materials and equipment furnished under this Contract will be of good quality and new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All Work not so conforming to these standards including alternatives not properly authorized may be considered defective. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. The warranty provided in this paragraph shall be in addition to and not in limitation of any other warranty required by the Contract Documents.

4.4.2 The Contractor shall warrant to the Owner all products, equipment, furnishings, systems, and installations for a period of one year from the date of Substantial Completion. Warranties shall be extended beyond one year where indicated in the technical specifications.

4.5 **TAXES**

4.5.1 The Contractor shall be responsible for and shall pay all applicable sales, use, excise or other taxes required by law on all materials, tools, apparatus, equipment, fixtures, services, incidentals or otherwise which may be purchased or used in connection with the Work or portions thereof.

4.5.3 The Contractor shall furnish to the Owner a fully completed form W-9 "Request for Taxpayer Identification Number and Certification".

4.6 **PERMITS, FEES AND NOTICES**

4.6.1 The Contractor shall secure all building permits, which shall be paid for by the Owner. The Contractor shall be responsible for miscellaneous inspection fees, certificates, and licenses necessary for the proper execution and completion of the Work. Each Prime Contractor shall be responsible to obtain appropriate building permits by the Township.

4.6.2 The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and orders of any public authority bearing on the performance of the Work. If the Contractor observes that any of the Contract Documents are at variance therewith, in any respect, he shall promptly notify the Architect in writing, and any necessary changes shall be adjusted by appropriate modification. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the

GENERAL CONDITIONS OF THE CONTRACT - 8

Architect, he shall assume full responsibility therefor and shall bear all costs attributable thereto.

4.7.3 The Contractor shall comply with all aspects of the Federal Occupational Safety and Health Act of 1970 (O.S.H.A.) including specific responsibilities to perform reporting and recording requirements. The Contractor is responsible to obtain information regarding his responsibilities under the Act.

4.7 **ALLOWANCES**

4.7.1 Cash allowances are not to be included in the bid specifications. The Contractor shall include in the contract sum only those allowances stated in the Bid Form – Proposal.

4.7.2 Unless otherwise provided in the Contract Documents:

4.7.2.1 These allowances shall cover the cost to the Contractor, less any applicable trade discount, of the materials and equipment required by the allowance delivered at the site, and all applicable taxes.

4.7.2.2 The Contractor's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the allowance shall be included in the allowance.

4.7.2.3 Unused allowances shall become the property of the Owner and shall be returned to the Owner or, in the alternative, Owner shall be provided a credit against the contract sum for any unused allowances with a Change Order to the Contract.

4.8 **SUPERINTENDENCE**

4.8.1 The Contractor shall employ a competent superintendent and necessary assistant who shall be in attendance at the project site at all times during the performance of the Work. The superintendent shall be on-site full time from the "Notice to Proceed" date and shall not be changed except with the consent of the Architect, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ. The superintendent shall represent the Contractor and all communications with the superintendent shall be as binding as if given to the Contractor. In the event more than one contract is awarded to the Contractor a separate superintendent shall be provided for each contract.

4.8.2 If during the course of the project it is evidenced that the Superintendent is not competent or is not managing the progress of the project or is not coordinating the various trades under the Contractor's supervision, then the Architect will document such findings to the Contractor. If, within 10 days of receiving such notice, no substantial effort or correction of the findings is made, then the Architect, with Owner's consent, may require the replacement of the Superintendent with an acceptable Superintendent.

4.8.3 The Superintendent shall be on site until the day of Substantial Completion and for such additional time thereafter as the Architect may determine to be necessary for the expeditious completion of the Work.

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4.9 **RESPONSIBILITY FOR THOSE PERFORMING THE WORK**

4.9.1 The Contractor shall be responsible to the Owner for the acts and omissions of all his employees and all Subcontractors, their Agents and employees, and all other persons performing any of the work under a contract with the Contractor.

4.10 **DRAWINGS AND SPECIFICATIONS AT THE SITE**

4.10.1 The Contractor shall maintain at the site for the Owner one copy of all drawings, specifications, addenda, approved shop drawings, change orders and other modifications, in good order and marked to record all changes made during construction. These shall be available to the Architect. The drawings, marked to record all changes made during construction, shall be delivered to the Architect, upon Substantial Completion of the work. Final payment will not be made until these documents are received by the Architect from the Contractor.

4.11 **USE OF SITE**

4.11.1 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with any materials or equipment.

4.11.2 Contractors will comply with all the Owner's regulations and policies while on the Owner's property, as well as any special regulations adopted by the Owner relating to this Project.

4.11.3 Contractor and Subcontractors shall make arrangements for material and equipment deliveries. Under no circumstances will the Owner's representatives or school personnel sign for deliveries or furnish labor to unload delivery trucks.

4.11.4 Parking of all vehicles shall be at locations designated by the Owner. Maintain posted vehicle speeds on school property. Note requirements that all building and site finish materials be returned to original condition.

4.12 **CUTTING AND PATCHING OF WORK**

4.12.1 The Contractor shall do all cutting, fitting or patching of his work that may be required to make its several parts fit together properly, and shall not endanger or damage any other work, including the work of Owner or separate contractors, by cutting, excavating or otherwise altering the work or any part of it. All areas requiring cutting, fitting, and patching shall be restored to the condition existing prior to the cutting, fitting, and patching, unless otherwise required by the Contract Documents.

4.13 **CLEANING UP**

4.13.1 The General Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by his operations or the operations of all other Prime Contractors. At the completion of the work he shall remove all waste materials and rubbish from and about the project as well as all his tools, construction equipment,

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machinery and surplus materials, and shall leave the work "broom clean" or its equivalent, except as otherwise specified. General Contractor shall provide all final cleaning operations in accordance with provisions in Section 01770 "Closeout Procedures."

4.13.2 If the Contractor fails to clean up, the Owner may do so and the cost thereof shall be charged to the Contractor as provided in paragraph 3.4.

4.14 **COMMUNICATIONS**

4.14.1 The Contractor shall forward all communications to the Owner through the Architect.

4.15 **INDEMNIFICATION**

4.15.1 It is hereby mutually covenanted and agreed that the status of the Contractor in the work to be performed by him under this contract is that of an independent Contractor and that as such he shall properly safeguard against any and all injury or damage to the public, to public and private property, materials and things and that as such he alone shall be responsible for any and all damage, loss or injury to persons or property that may arise, or be incurred in or during the conduct or progress of said work without regard to whether or not the Contractor, his Subcontractors, agents, or employees have been negligent, and that Contractor shall keep the Owner and Architect free and discharged of any and all responsibility and liability therefor of any sort or kind; that the Contractor shall assume all responsibility for risks or casualties of every description for any or all damages, loss or injury to persons or property arising out of the nature of the work, from the action of the elements, or from any unforeseen or unusual difficulty, that the Contractor shall assume and be liable for all blame and loss of whatsoever nature by reason of neglect or violation of any Federal, State, County, or local laws, regulations or ordinances.

4.15.2 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's Consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, or the acts or omissions of Contractor, its Subcontractors, sub-subcontractors, suppliers, or anyone directly or indirectly employed by any of them or anyone for whose acts they may be liable, regardless of whether or not such claim, demand, cause of action, damage, liability, loss, or expense is caused in part by an Indemnitee. Such obligation shall not extend to claims, demands, causes of action, damages, liabilities, losses, or expenses to the extent they result from the gross negligence or willful misconduct of any Indemnitee.

4.15.3 In claims against any person or entity Indemnitee under this Section by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Article 4.15.2 shall not be limited by any limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

4.15.4 The Contractor and each Subcontractor, of whatever tier, hereby certifies to the Owner that it complies with all employment related laws and regulations governing employment or collective bargaining agreements, if any. Nothing in this Agreement shall be construed as divesting any Contractor or Subcontractor of its sole and exclusive right to

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control the means, manner or method of performance of the Work of any Contractor or their employees. Nothing in this Agreement shall be construed in a manner that would be violative of the legal or contractual rights of any employee. The Contractor, and each Subcontractor, regardless of tier, shall defend, hold harmless and indemnify the Owner against and from any and all claims, demands, suits, actions, costs and expenses including reasonable attorneys' fees, growing out of any claims by an employee or independent contractor of any Contractor or Subcontractor of any tier alleging the violation of any of the individuals' employment rights, whether legal, constitutional or contractual in nature. This provision shall be accorded the broadest meaning permitted by law.

4.15.5 Contractor shall defend each Indemnitee, through counsel approved by such Indemnitee in any action, proceeding, or arbitration brought against the Indemnitee by reason of any claim described in this Article 4.15. The Contractor's obligation to defend an Indemnitee shall not extend to any action, proceeding, or arbitration that asserts or alleges only that the injury to the claimant resulted solely from the gross negligence or willful misconduct of the Indemnitee and from no other cause or if a final judgment is obtained establishing that injury to the claimant resulted solely from the gross negligence or willful misconduct of the Indemnitee.

4.15.6 If any claim of lien or stop-notice or any other demand for payment or security therefore, including claims or demands upon performance and payment bond sureties for this Agreement, is made or filed with the Owner or the Project by any person claiming that Contractor or any Subcontractor or supplier or any other person making a claim by reason of having provided labor, materials and/or equipment to any of them has failed to perform its contractual obligations or to make payment for any labor, services, trust fund contribution, materials, equipment, taxes, or other item furnished or obligation incurred for, or in connection with, the Work, or if at any time there shall be evidence of such nonperformance or nonpayment of any claim or lien or stop-notice or other demand for which, if established, the Owner or the Project might become liable, then the Owner shall have the right to retain from any payment then or thereafter due under the Contract or to be reimbursed by Contractor for an amount sufficient to (a) satisfy, discharge and defend against any such claim of lien or stop-notice or other demand, or any action or proceeding thereon that may be brought to judgment or award; (b) make good any such nonpayment, nonperformance, damage, failure or default; and (c) compensate the Owner for and indemnify it against any and all loss, liability, damage, cost, and expense (including attorneys' and consultants' fees and costs) sustained or incurred in connection therewith.

4.15.7 If any Subcontractor, supplier or other person claiming under any of them makes, records, files, or maintains any action on or respecting a claim of mechanic's lien, stop-notice, equitable lien, payment or performance bond, or a lis pendens, relating to the Work, the Contractor shall immediately and at its own expense, procure, furnish and record appropriate release bonds which will extinguish or expunge said claim, stop-notice, or lis pendens.

4.16 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

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

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

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

4.16.4 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the Project submittal schedule approved by the Architect, or in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Prime Contractors or the Owner's own forces. The Contractor shall cooperate with the Architect in the coordination of the Contractor's Shop Drawings, Product Data, Samples and similar submittals with related documents submitted by other Prime Contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect without action. The Contractor shall forward to the Architect a copy of the transmittal covering each such submittal.

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

4.16.6 To better facilitate the shop drawings process, copies of Floor Plan Backgrounds will be made available in electronic format to all Prime Contractors subject to the following provisions:

4.16.6.1 The Contractor shall execute and submit the release and indemnification provided and requested by the Architect or Consultants.

4.16.6.2 The data contained in any and all electronic files is copyright protected by the Architect and shall be used solely for the facilitation of the shop drawing process on this Project only. Any other use that is not consistent with this intended use is strictly prohibited. Any misuse will be punishable to the fullest extent of the law.

4.16.6.3 Electronic media will only be made available to Prime Contractors. Direct requests from Subcontractors will not be honored. Prime Contractors shall bear the responsibility of distribution to their Subcontractors, if desired. Requests shall be made in writing directly to the Architect and shall indicate the list of drawings requested (indicate by drawing number). Drawings will be provided in .dwg format issued electronically over the internet.

4.16.6.4 The cost of electronic files is hereby established as the following: Two hundred dollars (\$200) for the Floor Plan Backgrounds. The Floor Plan Backgrounds will be limited to walls, stairs, doors, windows, room names & numbers, built-in casework, plumbing fixtures, and toilet partitions.

For all other requests received per 4.16.6.3, the Architect will then calculate the cost of compiling the request and issue a total price to the Prime Contractor. Payment by the Prime Contractor must be received in full prior to the Architect preparing or releasing any electronic files.

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4.16.6.5 The Prime Contractor shall thoroughly check all information and details of the Drawings and be satisfied that all information and details are correct. Information concerning existing conditions, if applicable, shall be thoroughly field checked and verified. Incorrect information and details shall immediately be called to the attention of the Architect. **Please note that Addenda Information will not be included on the electronic files.** The Prime Contractor shall be responsible for incorporating all pertinent Addenda information.

4.16.6.6 The Owner, the Architect, and the Architect's Consultants shall not be held responsible for any costs or other liabilities resulting from the use of electronic files or the failure of the Prime Contractor to detect errors and omissions concerning matters within his contractual responsibility through the use of said electronic files. The Prime Contractor shall indemnify, defend, and hold harmless, to the fullest extent permitted by law, the Owner, the Architect, and the Architect's Consultants, their directors, officers, agents, and employees from and against any and all claims, damages, losses and expenses, including attorney's fees arising out of the modification, misinterpretation, misuse of the electronic files, and for any and all errors or omissions alleged to have arisen out of the use of any electronic files.

4.16.6.7 Nothing herein contained shall be construed as constituting a guarantee, warranty or assurance, either expressed or implied, by any party, that the electronic files will yield or accomplish the Prime Contractor's desired outcome.

ARTICLE 5

SUBCONTRACTORS

5.1 DEFINITION

5.1.1 A Subcontractor is a person or organization who has a direct contract with the Contractor to perform any of the work at the site. The term Subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative.

5.1.2 A Sub-subcontractor is a person or organization that has a direct or indirect contract with a Subcontractor to perform any of the work at the site. The term Sub-subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Sub-subcontractor or an authorized representative thereof.

5.1.3 Nothing contained in the Contract Documents shall create any contractual relation between the Owner or the Architect and any Subcontractor or Sub-subcontractor.

5.2 AWARD OF SUBCONTRACTS

5.2.1 Within 21 days after the date of receipt of the Notice to Proceed, the Contractor shall submit to the Architect the names of all Subcontractors and Sub-subcontractors for each category of work. The list shall include the name, address, telephone number, and contact personnel and the extent or limitations of the trades or work included by specification sections. Submission of more than one name per category of work will not be acceptable. In addition, submit a complete list of materials each Subcontractor and Sub-subcontractor proposes to

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use. Each Subcontractor shall submit (1) a written certification that his portion of the work shall comply with each and every requirement of the Contract Documents, including all warranty requirements and (2) an executed PA Public Works Verification Form. No Subcontractor may perform any portion of the Work on the Project site unless the Contractor has submitted the required certification. The written certification of Subcontractor's Compliance shall be made on the form titled "Subcontractor Certification of Compliance", a copy of which is included in the specifications.

5.2.2 If the Owner or Architect requests additional reference, each Subcontractor or Sub-subcontractor shall submit his reference in the form of a list of at least five projects similar in size and quality to this project performed in the last 5 years with name and location of work, dollar value and names of Owner and Architect.

5.2.3 Sources of supply of materials and the name of materials, articles and pieces of equipment, including those under subcontracts shall be submitted in the same manner as for Subcontractors.

5.2.4 The Contractor shall not contract with any Subcontractor or materials supplier until the above submissions are reviewed and approved by the Architect and Owner. Such review need not be given until the Contractor submits to the Architect a written statement concerning the proposed award which statement shall contain all information that the Architect may require.

5.2.5 The Contractor shall not substitute a Subcontractor, person, entity, or materials supplier who has been accepted by the Owner and the Architect, unless the substitution is acceptable to the Owner and the Architect in writing.

5.2.6 If the Owner or the Architect has reasonable objection to any such proposed Subcontractor or materials supplier, the Contractor shall submit a substitute to whom the Owner or the Architect has no reasonable objection. There shall be no adjustment in the contract sum because of such substitution.

5.3 **SUBCONTRACTURAL RELATIONS**

5.3.1 All work performed for the Contractor by a Subcontractor shall be pursuant to an appropriate written agreement between the Contractor and the Subcontractor (and where appropriate between Subcontractors and Sub-subcontractors) which shall contain provisions that:

5.3.1.1 Preserve and protect the rights of the Owner and the Architect under the Contract Documents with respect to the work to be performed under the subcontract so that the subcontracting thereof will not prejudice such rights;

5.3.1.2 Require that such work be performed in accordance with the requirements of the Contract Documents;

5.3.1.3 Require submission to the Contractor of applications for payment under each subcontract to which the Contractor is a party, in reasonable time to enable the Contractor to apply for payment in accordance with paragraph 9.3;

5.3.1.4 Require that all claims for additional costs, extensions of time with respect to subcontracted portions of the work shall be submitted to the

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Contractor (via any subcontractor or Sub-subcontractor where appropriate) in sufficient time so that the Contractor may comply in the manner provided in the Contract Documents for like claims by the Contractor upon the Owner;

5.3.1.5 Waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by the property insurance described in Article 11 except such rights as they may have to the proceeds of such insurance held by the Owner; AND

5.3.1.6 Obligate each Subcontractor specifically to consent to the provisions of this Article 5.

5.3.1.7 Require each Subcontractor, to the extent of the Work to be performed by Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility of safety of the Subcontractor's Work, which the Contractor, by the Contract Documents assumes toward the Owner and Architect.

5.4 **PAYMENTS TO SUBCONTRACTORS**

5.4.1 Contractor and any subcontractor shall comply with the prompt payment provisions of the Commonwealth Procurement Code, 62 Pa.C.S.A. § 3931 et seq.

5.4.2 The Architect may, on request and at his discretion, furnish to any Subcontractor, if practicable, information regarding percentage of completion certified to the Contractor on account of work done by such Subcontractors.

5.4.3 Neither the Owner nor the Architect shall have any obligation to pay or to see to the payment of any moneys to any Subcontractor or Sub-subcontractor except as may otherwise be required by law.

5.4.4 Each subcontract agreement for a portion of the work is assigned by the Contractor to the Owner provided that:

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to paragraph 14.2 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor in writing; and

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

5.5 **SUBCONTRACTOR INSURANCE**

5.5.1 The Subcontractor shall purchase and maintain liability insurance as set forth in Article 11 of the General Conditions of the Contract.

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ARTICLE 6

SEPARATE CONTRACTS

6.1 OWNER'S RIGHT TO AWARD SEPARATE CONTRACTS

6.1.1 The term "Separate Contractor(s)" shall mean other Contractors retained by the Owner under separate agreements. The Owner reserves the right to award other contracts in connection with other portions of the project under these or similar Conditions of the Contract.

6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall be the Contractor who signs each separate contract.

6.2 MUTUAL RESPONSIBILITY OF CONTRACTORS

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

6.2.2 If any part of the Contractor's work depends for proper execution or results upon construction or operations by other separate Contractors or other Prime Contractors, the Contractor shall inspect and promptly report to the Architect any apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor to report shall constitute an acceptance of the other Contractor's work as fit and proper to receive The Contractors Work, except as to defects which may develop in the other separate Contractor's work after the execution of the Contractor's work.

6.2.3 Should the Contractor cause damage to the work or property of any separate Contractor on the project, the Contractor shall, upon due notice, settle with such other Contractor by agreement or arbitration, if he will so settle. If such separate Contractor sues the Owner or initiates an arbitration proceeding on account of any damage alleged to have been so sustained, the Owner shall notify the Contractor who shall defend such proceedings at the Contractor's expense, and if any judgment or award against the Owner arises therefrom, the Contractor shall pay or satisfy it and shall reimburse the Owner for all attorney's fees and court or arbitration costs which the Owner has incurred.

6.2.4 The General Contractor will be in charge of and be responsible for the entire building operation from beginning of the project until acceptance by the Owner.

6.2.5 Each Prime Contractor shall cooperate with all other Contractors in forwarding the interest of the Owner, and shall coordinate his work with that of all other Contractors under the general direction of the General Contractor, who shall be in charge of the progress of the project and all divisions and subdivisions thereof.

6.2.6 Any conflict in or between the drawings and specifications as to which of the separate Contractors are to perform specific work shall be resolved by the Architect, whose decision shall be final and binding.

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6.2.7 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor, excepting, however, Owner and Architect who shall not be liable to any Contractor or Subcontractor for claims or damages of monetary or other nature caused by or arising out of delays contemplated or not contemplated at the signing of the Contract. The sole remedy against Owner and Architect for delays shall be the allowance to a successful claimant of additional time for completion of work. If, notwithstanding the above, Owner is required to reimburse a separate contractor because of delays, lack of performance, improperly timed activities, or defective construction of the Contractor that failed to perform shall be reimburse by the Owner for the costs incurred by the Owner which are payable to the separate contractor because of delays, improperly timed activities, or defective construction of the Contractor. To the extent necessary to effectuate the terms and conditions of this subparagraph, the separate prime contractors are granted third-party beneficiary status to this contract between Owner and Contractor.

6.3 OPENINGS IN FLOORS, WALLS AND ROOF

6.3.1 Each Contractor is responsible for the size and location of all openings in walls, floors, or roofs required for the proper installation of work under their respective contracts.

6.3.2 Each Contractor shall be responsible to furnish and install in the proper location all sleeves for pipe or conduit penetrations through floors and concrete or masonry walls in sufficient time so as not to impede or delay the progress of the General Contractor. In the event that sleeves are omitted, or not installed in time, the respective HVAC, Plumbing or Electrical Contractor shall, at his own expense, core drill the required openings.

6.3.3 The General Contractor shall be responsible to provide all "framed" openings for ducts or chases where indicated on the drawings. However, the HVAC Contractor shall be responsible to transmit in writing exact dimensions of the location and size of each framed opening in sufficient time so as not to impede or delay the progress of the General Contractor.

6.3.5 Recesses for panelboards, cabinet heaters, drinking fountains, etc. shall be provided by the General Contractor. However, the HVAC, Plumbing, and Electrical Contractors shall be responsible to notify the General Contractor of the exact location and size of required recesses in sufficient time so as not to impede or delay the work of the General Contractor.

6.4 OWNER'S RIGHT TO CLEAN UP

6.4.1 If a dispute arises between the separate Contractors as to their responsibility for cleaning up as required by Article 4.13, the Owner may clean up and charge the cost thereof to the several Contractors as the Architect shall determine to be just.

ARTICLE 7

MISCELLANEOUS PROVISIONS

7.1 GOVERNING LAW

7.1.1 The Contract shall be governed by the laws of the Commonwealth of Pennsylvania.

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7.2 SUCCESSORS AND ASSIGNS

7.2.1 The Owner and the Contractor each binds himself, his partners, successors, assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party in respect to all covenants, agreements and obligations contained in the Contract Documents. Neither party to the contract shall assign the contract or sublet it as a whole without the written consent of the other, nor shall the Contractor assign any moneys due or to become due to him hereunder, without the previous written consent of the Owner. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

7.3 WRITTEN NOTICE

7.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or member of the firm or to an officer of the corporation for whom it was intended or if delivered at or sent by registered or certified mail to the last business address known to him who gives the notice.

7.4 CLAIMS

7.4.1 A Claim is a demand or assertion by the Contractor seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be initiated by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

7.4.2 Any claim by Contractor, other than a claim for extension of time pursuant to paragraph 8.3, must be initiated within seven (7) days after occurrence of the event giving rise to such claim. Claims must be initiated by written notice to the Architect and Owner.

7.4.3 Pending final resolution of a claim, except as otherwise agreed in writing or as provided in subparagraph 9.3.11 and/or Article 14, the Contractor shall proceed diligently with performance of the Contract.

7.4.4 If the Contractor wishes to make a claim for an increase in the contract sum, written notice as provided herein shall be given before proceeding to execute the work. Prior notice is not required for claims relating to an emergency endangering life or property.

7.4.5 Contractor waives claims against Owner for consequential damages arising out of or relating to this Contract, including, but not limited to, damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the work.

7.5 RIGHTS AND REMEDIES

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

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

7.6 ROYALTIES AND PATENTS

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

7.7 TESTS

7.7.1 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any work to be inspected, tested or approved, the Contractor shall give the Architect timely notice of its readiness and of the date arranged so the Architect may observe such inspection, testing or approval. The Contractor shall bear all costs of such inspections, tests and approvals unless otherwise provided.

7.7.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval, which subparagraph 7.7.1 does not include, the Architect will, upon written authorization from the Owner, instruct the Contractor to order such additional inspection, testing or approval, and the Contractor shall give notice to the Architect as set forth in subparagraph 7.7.1. If such special inspection or testing reveals a failure of the work to comply (1) with the requirement of the Contract Documents OR (2) with respect to the performance of the work, with laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, the Contractor shall bear such costs thereof, including the Architect's additional services made necessary by such failure; otherwise the Owner shall bear such costs, and an appropriate change order shall be issued.

7.7.3 Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the Architect.

7.7.4 If the Architect wishes to observe the inspections, tests or approvals, required by this Article 7.7, he will do so promptly and, where practicable, at the source of supply.

7.7.5 Neither the observations of the Architect in his administration of the construction contract, nor inspections, tests or approvals by persons other than the Contractor shall relieve the Contractor from his obligations to perform the work in accordance with the Contract Documents.

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7.8 **CLAIM RESOLUTION**

7.8.1 **Mediation:**

7.8.1.1 If a dispute arises out of or relates to the Contract for Construction or the breach thereof, and has not been resolved through negotiation, then, at the Owner's sole and exclusive option and upon written demand served by the Owner upon the Contractor, the parties agree first to try to resolve such dispute by mediation under the Construction Industry Mediation Rules of the American Arbitration Association then in effect, before resorting to any other arbitration or judicial proceedings. Nothing contained in this paragraph is intended, or shall be construed, to entitle the Contractor or the Architect to demand mediation, it being understood and agreed that such determination shall be at the sole election of the Owner.

7.8.1.2 Unless otherwise mutually agreed in writing, the Contractor shall carry on with its duties and services under the Contract for Construction during any mediation proceedings, and the Owner shall continue to make payments to the Contractor in accordance with the Contract for Construction.

7.8.2 **Arbitration:**

7.8.2.1 All claims, disputes and other matters in question between the Contractor and the Owner arising out of, or relating to, the Contract for Construction or the breach thereof shall, at the Owner's sole and exclusive option, be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then in effect. The Owner's election to arbitrate shall be specifically enforceable under the prevailing arbitration law. In the event the Owner elects arbitration, the award rendered by the arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof. Nothing contained in this paragraph is intended, or shall be construed, to entitle the Contractor or the Architect to demand arbitration, it being understood and agreed that such determination shall be at the sole election of the Owner.

7.8.2.2 Notice of the Demand for Arbitration shall be filed in writing with the other party and with the American Arbitration Association. The Demand for Arbitration shall be made within a reasonable time after the claim, dispute or other matter in question has arisen, and in no event shall it be made after the date when institution of legal or equitable proceedings based on such claim, dispute or other matter in question would be barred by the applicable statute of limitations; it being understood, however, that such bar shall not apply to the Owner to the extent of the Owner's right to be free or otherwise exempt therefrom under applicable law.

7.8.2.3 Unless otherwise mutually agreed in writing, the Contractor shall carry on with its duties and services under the Contract for Construction during any arbitration proceedings, and the Owner shall continue to make payments to the Contractor in accordance with the Contract for Construction.

7.8.2.4 If the Owner becomes a party to any arbitration with the: (a) Architect, whether as a claimant or respondent, which involves a common question of fact or law with any claim, dispute or other matter in question

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between the Owner and the Contractor arising out of or relating to the Contract for Construction or the breach thereof; or (b) one or more separate contractors, whether as claimant or respondent, which involves a common question of fact or law with any claim, dispute or other matter in question between the Owner and the Contractor arising out of or relating to the Contract for Construction or the breach thereof, then the Owner, if it elects to do so, may require: (1) the Contractor to arbitrate such claim, dispute or other matter in question in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then in effect; (2) the Architect or the separate contractor(s), or all of them, to arbitrate such claim, dispute or other matter in question in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then in effect; and (3) that all such claims be heard in a single arbitration proceeding or that any separate arbitration proceedings involving such claims be consolidated.

7.8.3

Owner's Election:

7.8.3.1 The Owner may elect mediation at any time, regardless of whether arbitration or judicial proceedings have been commenced, and the Owner's commencement of or participation in such arbitration or judicial proceedings shall not waive the Owner's right to later elect mediation.

7.8.3.2 The Owner may elect arbitration at any time, regardless of whether the Owner has previously elected mediation or whether judicial proceedings have been commenced, and the Owner's commencement of or participation in such mediation or judicial proceedings shall not waive the Owner's right to later elect arbitration.

7.8.3.3 The Contractor may not commence any judicial proceedings against the Owner without first offering the Owner the opportunity to initially elect mediation or arbitration by notifying the Owner in writing of the nature of the dispute, the factual basis for its claims, and the amount or other relief claimed. If the Owner does not make its election within thirty (30) days after such notice, the Contractor may proceed to resolve such dispute through judicial proceedings. Any such judicial proceedings shall be instituted in the Court of Common Pleas of Montgomery County. The Owner's failure to elect mediation or arbitration within such thirty (30) day period shall not, however, waive the Owner's right to later elect mediation or arbitration.

7.8.3.4 Except as provided in paragraphs 7.8.3.1 through 7.8.3.2, in the absence of the Owner's election for mediation or arbitration, the parties shall have the right to resolve their disputes under the Contract for Construction through judicial proceedings. Any such judicial proceedings shall be instituted in the Court of Common Pleas of Montgomery County.

7.8.3.5 The Owner shall have the right to elect mediation and/or arbitration with the Contractor's Surety under the surety bonds to the same extent and in the same manner as the Owner's right to so elect with the Contractor under this Article 7. The Surety shall be bound by the terms of this Article 7 with respect to any mediation or arbitration elected by the Owner under the surety bonds and shall assume toward the Owner all of the duties, obligations and responsibilities which the Contractor assumes toward the Owner under this Article 7 in the event of such an election.

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ARTICLE 8

TIME

8.1 DEFINITIONS

8.1.1 The Contract Time is the period of time, including authorized adjustments, allotted in Section 011000 “Summary of Work” for Substantial Completion of each Contract or Phase of construction.

8.1.2 The date of Substantial Completion of the work or designated portion thereof, is the date certified by the Architect when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner may occupy or utilize the work or designated portion thereof for the use for which it is intended, as expressed in the Contract Documents. In no event, however, shall the Work, or any designated portion thereof, be certified as Substantially Complete until: (a) at least ninety percent (90%) of the Work, or designated portion thereof, has been completed (for the purpose of determining when 90% of the Work, or any designated portion thereof, has been completed, Work does not include the Contractor’s overhead and profit, general conditions, or supervision); and (b) the Contractor has obtained approval from all agencies having jurisdiction over the Work, or any designated portion of the Work, and obtains appropriate Certificates of Occupancy for the Work, or designated portion of the Work.

8.1.3 The term day as used in the Contract Documents shall mean calendar day.

8.2 PROGRESS AND COMPLETION

8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time (including Phasing Schedule and all events, activities, and milestones) is a reasonable period for performing the Work. The dates listed in the Construction Schedule are of the essence and the Contractor agrees to schedule, coordinate, and staff in accordance therewith based on the actual progress of the Work as necessary to maintain orderly progress of the Work in accordance with the construction schedule.

8.2.2 The Contractor shall begin the work on site no later than ten (10) days following receipt of the Notice to Proceed and shall carry the work forward expeditiously to Substantial Completion. Thereafter, the Contractor shall expeditiously correct and complete the list of deficiencies appended to the Certificate of Substantial Completion within sixty (60) days of the date of Substantial Completion of each phase of the Work.

8.3 DELAYS AND EXTENSION OF TIME

8.3.1 If the Contractor is delayed at any time in the progress of the work by significant changes ordered in the Work, then the contract time shall be extended for such reasonable time as the Architect may determine. Neither rock excavation, weather conditions, failure of the Contractor to enclose the building for winter weather, or any other condition shall be considered as cause for an extension of the contract time. Where the delay arises from acts, omissions, or defaults of another Contractor or the other Contractor’s Subcontractors and

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suppliers, then the Contractor will not be entitled to an extension of time and its sole remedy will be an arbitration proceeding pursuant to paragraph 6.2.3 of the General Conditions.

8.3.2 All claims for extension of time shall be made in writing to the Architect no more than ten days after the occurrence of the delay; otherwise they shall be waived. In the case of a continuing cause of delay only one claim is necessary.

8.3.3 If no schedule or agreement is made stating the dates upon which written interpretations as set forth in paragraph 1.2.5 shall be furnished, then no claim for delay shall be allowed on account of failure to furnish such interpretations until fifteen days after demand is made for them, and not then unless such claim is reasonable.

8.3.4 Notwithstanding anything to the contrary in the Contract Documents, an extension in the contract time, to the extent permitted under this paragraph, shall be the sole remedy of the Contractor for (1) delay in the commencement, prosecution or completion of the work; (2) hindrance or obstruction in the performance of the work; (3) loss of productivity; or (4) other similar claims (collectively referred to in this subparagraph as delays) whether or not such delays are foreseeable, unless a delay is caused by the acts of the Owner constituting active interference with the Contractor's performance of the work, and only to the extent that such acts continue after the Contractor furnishes the Owner with written notice of such interference. In no event shall the Contractor be entitled to any compensation or recovery of any damages against the Owner or Architect in connection with any delay, including, without limitation, consequential damages, lost opportunity cost, impact damages or similar remuneration. The Owner's exercise or failure to exercise any rights or remedies under the Contract Documents (including without limitation, ordering changes in the work, or directing suspension, rescheduling or correction of the work), regardless of the extent or frequency thereof, shall not be construed as active interference with the Contractor's performance of the work.

ARTICLE 9

PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

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

9.2 CONTRACT BREAKDOWN

9.2.1 Within 10 calendar days after the signing of the "Agreement Between Owner and Contractor," the Contractor shall submit a detailed cost breakdown of all items of work entering into the contract to be used as a basis for review of monthly applications of payment. Items of work entering into the contract shall consist of a breakdown of not less than each Section of the Work set forth in the Specifications or greater when determined to be necessary by the Architect to properly monitor the work and confirm Applications for Payment.

9.2.2 All allowances must be itemized separately from the category of work.

9.2.3 Provide contractor breakdown information on AIA Documents G702 and G703.

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9.3 **PROGRESS PAYMENTS**

9.3.1 Each month the Contractor shall submit to the Architect an itemized application for payment prepared in accordance with the cost breakdown. The application for payment shall be supported by data substantiating the Contractor's right to payment. The form of Application for Payment shall be AIA Document G702, APPLICATION AND CERTIFICATE FOR PAYMENT, supported by AIA Document G703 Continuation Sheet (latest edition).

9.3.1.1 The Contractor shall warrant and certify with the submission of each Application for Payment that the Contractor has or will supply the Owner, through the Architect, Wage Certifications that comply with the Secretary of Labor and Industry's requirements. The Contractor shall further certify that all Wage Certificates will be deemed to be reason to withhold all or part of the amount covered by an Application for Payment and shall be a default under the Contract.

9.3.2 Materials in reasonable quantities, as approved by the Architect, which are delivered to the site and ready to be, but are not yet, incorporated into the work, may be included in a Certificate for Payment, if they are reasonably anticipated to be incorporated into the Work within 60 days and they are stored properly and protected in accordance with the manufacturer's/supplier's requirements so as not to compromise any warranty.

9.3.2.1 Materials Stored On Site: Materials properly stored at the construction site may be included in the Contractor's application for payment, subject to the following conditions: (1) All materials shall be stored in strict compliance with the manufacturer's recommendations in secure, dry enclosures; (2) Contractor shall provide property insurance covering materials stored at the construction site to the extent that Owner's property insurance does not provide coverage; (3) Contractor shall provide an accurate inventory of all materials included for payment with each application for payment. Contractor shall maintain the inventory until the materials are installed or otherwise incorporated into the work; and (4) Payment for materials stored on the construction site shall be limited to the actual, invoiced cost to the Contractor, F.O.B. the construction site. Contractor shall warrant that all suppliers are promptly paid in full for all materials included for payment and that materials are not encumbered by any lien, claim or mortgage that would prevent the Owner from taking full possession of the materials. Contractor shall produce satisfactory evidence of same to Owner.

9.3.2.2 Materials Stored Off Site. Materials stored off the construction site shall not be included for payment in the Contractor's application for payment unless prior written approval of the Owner has been obtained. Payment for materials stored off the construction site shall be subject to the conditions in subparagraph 9.3.2.1 and the following additional conditions:

- (1) Contractor shall provide property insurance for the full cost of the materials stored off the construction site;
- (2) Contractor shall provide a bill of sale for the materials granting clear title to the materials to the Owner;
- (3) Contractor shall provide waivers of liens, encumbrances or claims relating to the bailment of the materials stored off site or as otherwise required by Owner;

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- (4) Contractor shall provide Owner all information necessary for the filing of any notices under the Uniform Commercial Code relating to the materials stored off the construction site as may be required by Owner;
- (5) The materials stored off the construction site shall be clearly and conspicuously labeled so as to identify Owner's title to the materials and shall be segregated and not commingled with other materials at the storage location;
- (6) Contractor shall pay all storage costs, shall be responsible for any damage or deterioration of the materials while in storage or in transit to the construction site and shall pay the cost of inspection of the materials in storage by the Owner;
- (7) Contractor shall be responsible for and shall pay all costs of transportation of the materials to the construction site; and
- (8) Neither Owner's payment for materials stored off the construction site nor the transfer of title to Owner shall in any way reduce Contractor's liability for the complete installation and construction relating to said materials, the value of the materials or liability under any performance bond provided for the Project; and
- (9) Contractor shall pay the cost of inspection by the Owner of any and all materials in storage.

9.3.3 To ensure satisfactory completion of the Work under the Contract Documents, the Owner shall withhold a retainer from each progress payment in the amount of ten percent (10%) of the amount due the Contractor until fifty percent (50%) of the Work is completed. When the Work is fifty percent (50%) completed, one-half of the amount retained by the Owner may be returned to the Contractor, provided the Contractor provides written consent of the Surety to such reduction in retainage to the Architect with its Application for Payment, provided the Architect approves the Application for Payment and and reduction in retainage, and further provided that the Contractor is making satisfactory progress and there is not specific cause for greater withholding. A specific cause for greater withholding shall include, without limitation, the following:

9.3.3.1 The Contractor's inability to produce evidence satisfactory to the Architect and/or Owner evidencing payments for materials, labor and/or payments to Subcontractors, manufacturers or suppliers.

9.3.3.2 The existence of a dispute between the Owner and the Contractor regarding increased costs claimed by such Contractor.

9.3.3.3 Contractor's failure to complete the Work in accordance with the Contract Documents including, without limitation, the Drawings and Specifications; or

9.3.3.4 Defective or damaged Work identified subsequent to installation.

9.3.3.5 Failure to comply with any of the project requirements including, but not limited to, schedule, coordination, staffing, supervision, subcontractors, submittals, etc.

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9.3.4 The Owner shall retain from each progress payment in the amount of five percent (5%) of all due amounts due the Contractor after the Work is fifty percent (50%) completed. In the event a dispute arises between Owner and a separate Prime Contractor or separate Contractor, which dispute is based upon increased costs claimed by the Prime Contractor or separate contractor occasioned by delays, or other actions of the Contractor, additional retainage in the sum of one and one-half times the amount of any possible liability may be withheld until such time as a final resolution is agreed to by all parties directly or indirectly involved, unless the Contractor furnishes a bond satisfactory to the Owner to indemnify Owner against the claim.

9.3.4.1 The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Owner, and Architect, or if the Surety withholds its consent, or for other good and sufficient reasons.

9.3.4.2 All money retained by the Owner will be withheld from the Contractor until Substantial Completion of the Project.

9.3.5 Provided an application for payment is received by the Architect no later than the 1st day of the month for work completed up to the 25th day of the previous month, Architect will review, act and forward the application for payment to the Owner within 10 business days.

9.3.6 Approval of the Contractor's application for payment will constitute a representation by the Architect to the Owner, based on his observations at the site as provided in subparagraph 2.2.4 and the data comprising the application for payment that the work has progressed to the point indicated; that, to the best of his knowledge, information and belief, the quality of the work is in accordance with the Contract Documents (subject to an evaluation of the work for conformance with the Contract Documents upon substantial completion, to the results of any subsequent tests required by the Contract Documents, to minor deviations from the Contract Documents correctable prior to completion, and to any specific qualifications stated in his certificate); and that the Contractor is entitled to payment in the amount certified. However, by approving a payment, the Architect shall not thereby be deemed to represent that he has made exhaustive or continuous on-site inspections to check the quality or quantity of the work or that he has reviewed the construction means, methods, techniques, sequences or procedures, or that he has made any examination to ascertain how or for what purposes the Contractor has used the moneys previously paid on account of the contract sum.

9.3.7 As long as the Work is prosecuted in accordance with the Contract Documents and with such progress as may insure completion by the date set forth in the Form of Proposal and to the satisfaction of the Owner and except as otherwise provided herein, then the Owner will make progress payments to the Contractor in the amount set forth in the approved application for payment (less retainage) in the time period set forth in section 9.3.8 below.

9.3.8 Provided an Application for Payment is received by the Architect not later than the 1st day of a month for work completed up to the 25th day of the previous month, the Owner shall make progress payment to the Contractor based on the approved and Architect certified Application for Payment, not later than 30 days after the Architect's receipt of application for payment. If an Application for Payment is received by the Architect after the date fixed above, the application will be held until the next scheduled review of Applications for Payment in the following month and processed in that month in accordance with the above schedule. Failure to receive the payroll certification will result in payments being withheld.

9.3.9 No progress payment, nor any partial or entire use or occupancy of the project by the Owner, shall constitute an acceptance of any work not in accordance with the Contract Documents.

9.3.10 Nothing in this article shall create any obligation on the part of the Owner to pay, or see to the payment of, any sums to any Subcontractor and/or sub-subcontractor or to any other person.

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

9.3.12 If the Architect does not forward the application for payment to Owner through no fault of the Contractor, or if the Owner does not pay the Contractor the amount approved and certified by the Architect (and undisputed by Owner as provided in subparagraph 9.4.2) or awarded by arbitration, within the time line set forth in this paragraph, then the Contractor may, upon ten (10) additional days' written notice to Owner and Architect stop the work until payment of the amount owing has been received. The contract time shall be extended appropriately.

9.4 **PAYMENTS WITHHELD**

9.4.1 The Architect may withhold an Application for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner as provided in subparagraph 9.3.5. The Architect may also decline to approve any applications for payment or, because of subsequently discovered evidence or subsequent inspections, he may nullify the whole or any part of any certificate for payment previously issued to such extent as may be necessary in his opinion to protect the Owner from loss because of:

- 9.4.1.1 defective work not remedied;
- 9.4.1.2 third party claims filed or reasonable evidence indicating probable filing of such claims;
- 9.4.1.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials, or equipment;
- 9.4.1.4 reasonable doubt that the work can be completed for the unpaid balance of the contract sum;
- 9.4.1.5 damage to another Contractor;
- 9.4.1.6 reasonable indication that the work will not be completed within the contract time;
- 9.4.1.7 failure to carry out the Work in accordance with the Contract Documents;
- 9.4.1.8 failure to submit Wage Certification as required by the Department of Labor and Industry;
- 9.4.1.9 failure to comply with government statutes, laws, rules, regulations, ordinances and lawful orders of authorities with jurisdiction over the Project.

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- 9.4.1.10 failure to comply with Project milestones, phasing, coordination or scheduling requirements; or
- 9.4.1.11 failure to adequately staff the Project.

9.4.2 The Owner may withhold from the Contractor so much of any approved payments due him as may, in the judgment of the Owner, be necessary to protect the Owner from loss because of grounds stated in subparagraph 9.4.1.

9.4.3 When the above grounds in subparagraph 9.4.1 are removed, payment shall be made for amount withheld because of them.

9.4.4. Contractor expressly waives any right to penalties, interest and attorney's fees pursuant to the prompt payment provisions of the Pennsylvania Commonwealth Procurement Code, 62 Pa.C.S. § 3931 et seq.

9.5 **SUBSTANTIAL COMPLETION AND FINAL PAYMENT**

9.5.1 When the Contractor considers that the Work, or a designated phase thereof is substantially complete in accordance with the definition in Article 8, the Contractor shall prepare for submission to the Architect an application for payment (AIA Document G702) and a list of deficiencies ("Punch List") to be completed or corrected. Submit with the punch list all materials and equipment warranties, "as built" and record drawings, operating maintenance manuals, and all Certificates of Occupancy.

9.5.2 Upon receipt of the Contractor's Application for Payment and list of deficiencies, the Architect will make an inspection within 30 days to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect.

9.5.3 When the Work or designated portion thereof is substantially complete, the Architect will prepare a certificate (Exhibit "J") which shall establish the date of Substantial Completion, and which shall state the responsibilities of the Owner and the Contractor for security, maintenance, heat, light, utilities and insurance, shall include the lists of deficiencies and shall establish a reasonable cost of completion.

9.5.4 The Owner shall make payment within 30 days from the date of approval of the Application for Payment by the Owner, less only one and one-half times the cost of completion of the deficiencies listed on the certificate.

9.5.5 When all deficiencies have been corrected, the Contractor shall prepare and submit to the Architect a "Certification of Punchlist Completion").

9.5.6 Upon receipt of the "Certification of Punchlist Completion" from the Contractor, the Architect will promptly make an inspection. When he finds the work acceptable under the Contract Documents and the contract fully performed, he will notify the Contractor to submit the following standard form AIA Documents (3 copies each) properly executed, signed and notarized, a copy of which is included in these specifications:

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- 9.5.6.1 Final Application for Payment (G702)
- 9.5.6.2 Contractor's Affidavit of Payment of Debts and Claims (G706)
- 9.5.6.3 Contractor's Affidavit of Release of Liens (G706A)
- 9.5.6.4 Consent of Surety Company to Final Payment (G707)

9.5.7 The Architect will make up to (2) inspections to confirm that the list of deficiencies have been Substantially Completed after which the Architect/Owner will assess charges based upon Architect's standard hourly rates on the Contractor for the Architect's additional contract administration. Contractor shall be liable for all such charges and Owner may deduct same from any payment then or thereafter due and owing Contractor.

9.5.8 Upon receipt of the above AIA Documents, the Architect will process the final application for payment and submit same to the Owner with a recommendation for payment.

9.5.9 Architect's recommendation for payment shall constitute a representation that to the best of the Architect's knowledge, information and belief, and on the basis of Architect's on-site visits and inspections, the work has been completed in accordance with the terms and conditions of the Contract Documents and the entire balance found to be due the Contractor and noted in the Final Certificate is due and payable.

9.6 **PRIOR OCCUPANCY**

9.6.1 When prior occupancy or use of completed portions is requested by the Owner, the Architect will make a prior occupancy inspection to establish the conditions of the work at time of occupancy. Use and occupancy by the Owner prior to final acceptance does not relieve the Contractor of his responsibility to maintain all insurance and bonds required of the Contractor during the life of the contract. The Contractor shall not be held responsible for any damage to the occupied part of the project resulting from the Owner's occupancy. Occupancy by the Owner shall not be deemed to constitute acceptance of Work not complying with the requirements of the Contract Documents or a waiver of existing claims of the Owner against Contractor.

9.6.2 Prior occupancy shall require a written agreement between Owner and each Contractor stating the responsibility of each party, such as temporary electricity, fuel, building security, etc.

9.6.3 The Owner reserves the right to locate and install items of equipment within the building(s). Such installation shall not unreasonably interfere with the progress of the Contractors, and shall not include the connection of such equipment to its power source, except for testing. Such installation shall not be deemed an acceptance of the work in those areas by the Owner.

9.7 **FINAL PAYMENT**

9.7.1 When the Owner and Architect determine that all work listed or attached to the Certificate of Substantial Completion is complete and all requirements for final inspection are complete, the Architect will submit to the Owner a written statement to this effect and recommend final payment.

9.7.2 This statement shall include a summary of extras and credits and the net compensation thereof.

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9.7.3 Within thirty (30) days after the filing of such statement, the Owner shall pay to the Contractor the amount therein stated, less all prior payments and advances whatsoever to or for the account of the Contractor. All prior payments including those relating to extra work, shall be subject to correction by this payment. When the Owner makes final payment to the Contractor he shall send the Architect a statement of the fact for the Architect's records.

9.7.4 The making of final payment shall not constitute a waiver of all claims by the Owner except those arising from:

- 9.7.4.1 liens, claims, security interests or encumbrances arising out of the Contract and unsettled;
- 9.7.4.2 faulty or defective work appearing after acceptance;
- 9.7.4.3 failure of the work to comply with the requirements of the Contract Documents;
- 9.7.4.4 terms of any special guarantees required by the Contract Documents;
- 9.7.4.5 matters arising following such payment which were not within the reasonable contemplation of Owner when payment was made; or
- 9.7.4.6 claims previously made in writing and still unsettled.

9.7.5 The acceptance of final payment shall constitute a waiver of all claims by the Contractor except those previously made in writing and still unsettled.

9.7.6 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (i) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner and Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (ii) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (iii) consent of surety, if any, to final payment, (iv) final "as-built" prints of record drawings marked by the Contractor with record information as set forth in the Contract Documents, (v) a final Contractor's sworn statement showing all subcontractors and material and equipment suppliers to be fully paid and similar sworn statement from Subcontractors confirming that they have been paid, and (vi) if required by Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Contractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

ARTICLE 10

PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

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

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10.2 **SAFETY OF PERSONS AND PROPERTY**

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

- 10.2.1.1 employees on the Work, the Owner's employees, and representatives, students, visitors, and other persons who may be affected by the Work or the Contractor's operations.
- 10.2.1.2 all the work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractor or Sub-subcontractors; AND
- 10.2.1.3 other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
- 10.2.1.4 construction or operations by the Owner, other separate Contractors or other Prime Contractors, Subcontractors or Sub-subcontractors.

10.2.2 The Contractor shall comply with and give notices or reports required by applicable laws, statutes, ordinances, codes, rules, regulations and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying Owners and users of adjacent sites and utilities.

10.2.3 When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution of the work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of property qualified personnel. No explosives shall be used on the site without prior notice and written consent of Owner.

10.2.4 All damage or loss to any property referred to in clauses 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, any Subcontractor, any Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, shall be remedied by the Contractor, except damage or loss attributable to faulty drawings or specifications or to the acts or omissions of the Owner or Architect or anyone employed by either of them or for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under paragraph 4.15.

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

10.2.6 The Contractor shall not load or permit any part of the work to be loaded so as to endanger its safety.

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10.3 **EMERGENCIES**

10.3.1 In an emergency affecting the safety of persons, or property, the Contractor shall act to prevent threatened damage, injury or loss and shall immediately notify the Owner, Architect, and appropriate public safety authorities (e.g. police, EMS, fire service).

ARTICLE 11

INSURANCE

11.1 **CONTRACTOR'S LIABILITY INSURANCE**

11.1.1 From signing of the Agreement until ninety (90) days after Final Payment, the Contractor shall at his own expense, purchase and maintain in a company or companies licensed and authorized to do business in the Commonwealth of Pennsylvania, insurance as will protect him from claims set forth below which may arise out of or result from the Contractor's operations under the contract, whether such operations be by himself or by any Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- 11.1.1.1 claims under workmen's compensation, disability benefit and other similar employees benefit acts;
- 11.1.1.2 claims for damages because of bodily injury occupational sickness or disease, or death of his employees;
- 11.1.1.3 claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;
- 11.1.1.4 claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person;
- 11.1.1.5 claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- 11.1.1.6 claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance of a motor vehicle; and
- 11.1.1.7 claims involving contractual liability insurance applicable to the Contractor's obligations to indemnify the Owner under the Contract Documents.

11.1.2 The insurance required by subparagraph 11.1.1 shall be written for not less than any limits of liability specified in the Contract Documents, or required by law, whichever is greater, and shall include contractual liability insurance as applicable to the Contractor's obligations under Article 4.15.

11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the work. These certificates shall contain a provision that coverages afforded under the policies will not be canceled until at least thirty (30) days' prior written notice has been given to the Owner. The cancellation clause shall not be qualified in any manner or have any exclusions. (If requested by Owner, Contractor shall file a copy of all policies in lieu of the respective certificates of insurance for same.) The Owner and Architect shall be named as additional insured on all certificates of insurance. The policies used on the Certificate shall be primary.

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11.1.4 Insurance company shall have a current rating of A- or better and a size category of IX or larger as determined by the A. M. Best Company Insurance Services, or equivalent, in the sole discretion of the Owner. The insurance company shall be admitted to the Pennsylvania Insurance Guarantee Fund.

11.1.5 During the term of the contract, the Contractors shall, at their own expense, purchase, and maintain the following insurance in companies properly licensed and satisfactory to the Owner.

11.1.5.1 Workmen's Compensation and Employer's Liability Insurance:

- (a) Workmen's Compensation: Statutory
- (b) Employer's Liability: \$100,000

11.1.5.2 Contractor's Liability Insurance including blanket Contractual Liability. Form of insurance shall be Comprehensive General Liability including Products Liability and Completed Operations, XCU coverage to be included:

- (a) Bodily Injury:
 - \$1,000,000 each occurrence
 - \$2,000,000 aggregate
- (b) Property Damage, including Broad Form Property Damage:
 - \$1,000,000 each occurrence
 - \$2,000,000 aggregate
- (c) Personal Injury:
 - \$1,000,000 each person aggregate
 - \$2,000,000 general aggregate
- (d) Products Completed Operations Coverage:
 - \$1,000,000 per occurrence
 - \$2,000,000 aggregate
- (e) Aggregate limits shall be provided on a per project basis
- (f) Automobile Liability, owned, non-owned and hired vehicles:
 - \$1,000,000 combined single limit

11.1.5.3 Contractor's Excess/Umbrella Liability:

- (a) \$5,000,000 excess liability limit over the primary limits required under this article

11.2 OWNER'S LIABILITY INSURANCE (BY CONTRACTORS)

11.2.1 During the term of the contract, the Contractor shall, at their own expense, purchase and maintain the Owner's Protective Liability in the name of the Owner for the following minimum limits:

11.2.1.1 Bodily Injury:

\$1,000,000 each occurrence
\$2,000,000 aggregate

11.2.1.2 Property Damage:

\$1,000,000 each occurrence
\$2,000,000 aggregate

11.2.1.3 Personal Injury:

\$1,000,000 each occurrence
\$2,000,000 general aggregate

11.3 PROPERTY INSURANCE

11.3.1 Unless otherwise provided, the Owner may purchase and maintain property insurance upon the entire work at the site to the full insurable value thereof. This insurance shall include the interests of the Owner, and shall insure against the perils of Extended Coverage, Vandalism and Malicious Mischief.

11.3.2 The Owner shall purchase and maintain such steam boiler and machinery insurance as may be required by the Contract Documents or by law. This insurance shall include the interests of the Owner.

11.3.3 If the Contractor requests in writing that insurance for special hazards be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

11.4 LOSS OF USE INSURANCE

11.4.1 The Owner, at his option, may purchase and maintain such insurance as will insure him against loss of use of his property due to fire or other hazards, however caused.

11.5 SURETY BONDS

11.5.1 At the time of execution of the Contract for Construction and prior to commencing any Work, the Contractor shall furnish to the Owner a Performance Bond and a separate Labor and Material Payment Bond, each in an amount equal to the Contract Sum, on the forms provided by the Owner as part of the bid documents. The surety on such bonds must be listed on the United States Department of the Treasury list for sureties acceptable on federal construction projects (United States Department of the Treasury Circular No. 570) and

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must be licensed to engage in the insurance business in the Commonwealth of Pennsylvania. The Surety's obligations under the Performance Bond extend to all of the Contractor's obligations under the Contract Documents and the fact that certain provisions in the Contract Documents expressly refer to the Surety shall not be deemed or construed to limit the Surety's obligations in any way. Nothing contained in the Contract Documents is intended, or shall be construed, to afford the Contractor any right, claim or remedy under any Performance Bond furnished by any separate contractor, nor to afford any separate contractor any right, claim or remedy under the Performance Bond furnished by the Contractor.

11.5.2 The Contractor shall promptly provide a copy of the payment bond to any person or entity claiming to have rights thereunder.

ARTICLE 12

CHANGES IN THE WORK

12.1 CHANGES

12.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 12 and elsewhere in the Contract Documents.

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

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

12.1.4 In order to facilitate checking of quotations for adjustments in the Contract Sum, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including, labor, materials and subcontracts. Labor and materials shall be itemized in the manner prescribed herein. When major cost items are subcontracted, these costs shall be itemized also.

12.1.5 All Change Orders shall be accompanied by detailed breakdown.

12.2 CHANGE ORDERS

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

- 12.2.1.1 a change in the Work;
- 12.2.1.2 the amount of the adjustment in the Contract Sum, if any; and
- 12.2.1.3 the extent of the adjustment in the Contract Time, if any.

12.2.2 Methods used in determining adjustments to the Contract Sum may include the following methods in the following order of preference:

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- 12.2.2.1 mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- 12.2.2.2 unit prices stated in the Contract Documents or subsequently agreed upon;
- 12.2.2.3 cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- 12.2.2.4 cost determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change including in such determination the cost of the Work added and/or eliminated pursuant to the Change and applying in either case the applicable percentages for overhead and profit provided in the Contract Documents or, if none have been so stated, then as determined by Architect.

12.3 **CONSTRUCTION CHANGE DIRECTIVES**

12.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly. A Construction Change Directive may be used in the absence of total agreement on the terms of a Change Order.

12.3.2 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based upon the following methods in the following order of preference:

- 12.3.2.1 mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- 12.3.2.2 unit prices stated in the Contract Documents or subsequently agreed upon;
- 12.3.2.3 cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- 12.3.2.4 cost determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change including in such determination the cost of the Work added and/or eliminated pursuant to the Change and applying in either case the applicable percentages for overhead and profit provided in the Contract Documents or, if none have been so stated, then as determined by Architect.

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

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

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12.3.5 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit as set forth in the Agreement. In such case, and also under Clause 12.3.2.4, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Subparagraph 12.3.5 shall be limited to the following:

- 12.3.5.1 costs of labor, including customary benefits and workmen's compensation insurance;
- 12.3.5.2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- 12.3.5.3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- 12.3.5.4 costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- 12.3.5.5 additional costs of on-site supervision and field office personnel directly attributable to the change.

12.3.6 In the case of Construction Change Directives or Change Orders in which the adjustment is to be based on the method described in 12.3.2.2, then:

- 12.3.6.1 When a change in the work includes a category or categories of work both added to and deleted from the contract, the total quantities of added work and of deleted work shall be determined separately for each category and the appropriate unit price or net cost of the work shall be applied to the difference between the two total quantities; and
- 12.3.6.2 Unit Prices shall be considered inclusive of all costs and shall be applied to units of measure as set forth in the form of proposal for each category of the work.

12.3.7 Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment to the extent such Work was completed under the Construction Change Directive. When both additions and deductions are involved in any one change, the allowance for overhead and profit shall be figured on the basis of net increase or decrease, if any.

12.3.8 For all extra work by Change Order or by Change Order Directive performed directly by the Contractor, the gross cost to the Owner shall include the net cost of the work to the Contractor plus an allowance for overhead and profit not to exceed 15% of the net cost.

12.3.9 For all extra work by Change Order or by Change Order Directive performed directly by a Subcontractor, the Subcontractor's gross cost shall include the net cost of the work to the Subcontractor plus an allowance for overhead and profit not to exceed 15% of the Subcontractor's net cost. The Contractor's gross cost to the Owner shall include the Subcontractor's gross cost plus an allowance for overhead and profit not to exceed 5% of the Subcontractor's gross cost. In no case shall the total allowance for overhead and profit exceed 20% of the net cost of the work.

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12.3.10 Net cost of deleted or extra work shall be limited to cost of materials, including sales tax and cost of delivery, cost of labor, including social security, old age and unemployment insurance, and fringe benefits under collective bargaining agreements; workmen's compensation insurance; bond premium; and rental value of power tools and equipment.

12.3.11 Overhead shall include supervision, superintendence, wages of timekeepers, watchmen and clerks, hand tools, incidentals, general office expense and all other expenses not included in net cost and attributable to the change.

12.3.12 Gross costs shall be net costs plus overhead and profit.

12.4 **MINOR CHANGES IN THE WORK**

12.4.1 The Architect shall have authority to order minor changes in the work not involving an adjustment in the contract sum or an extension of the contract time and not inconsistent with the intent of the Contract Documents. Such changes may be effected by Field Order or by other written order. Such changes shall be binding on the Owner and the Contractor.

12.5 **ARCHITECT'S SUPPLEMENTAL INSTRUCTIONS**

12.5.1 The Architect may issue written Supplemental Instructions (AIA Form G710) which interpret the Contract Documents in accordance with subparagraph 1.2.5 or with other minor changes in the work in accordance with paragraph 12.4 without change in contract sum or contract time. The Contractor shall carry out such Supplemental Instructions promptly.

ARTICLE 13

UNCOVERING AND CORRECTION OF WORK

13.1 **UNCOVERING OF WORK**

13.1.1 If any work should be covered contrary to the request of the Architect, or to requirements specifically expressed in the Contract Documents, it must, if required by the Architect, be uncovered for his observation and replaced, at the Contractor's expense without change in the Contract Time.

13.1.2 If a portion of the Work has been covered which the Architect has not specifically requested to observe prior to being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense or at the expense of the Architect if the failure to request to observe the Work prior to it being covered was due to the negligence of the Architect. If such work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by one of the other Prime Contractors in which the event the other Prime Contractor shall be responsible for payment of such costs.

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13.2 CORRECTION OF WORK

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

13.2.2 If at any time, including any time following Final Completion, any of the work is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. Contractor's obligations under this section 13.2.2 shall survive acceptance of the Work by Owner under the Contract and/or termination of the Contract.

13.2.3 All such defective or non-conforming work under sub-paragraph 13.2.1 and 13.2.2 shall be removed and legally disposed of, off-site if necessary, and the work shall be corrected to comply with the Contract Documents without cost to the Owner.

13.2.4 The Contractor shall bear the cost of making good all work of separate Contractors destroyed or damaged by such removal or correction.

13.2.5 If the Contractor fails to correct such defective or non-conforming work, the Owner may correct it in accordance with paragraph 3.4.

13.2.6 The Contractor is solely responsible for determining and performing the necessary corrective action to bring any nonconforming work into compliance with the requirements of the Contract Documents. The Contractor shall, at its sole cost and expense, engage the services of appropriate design professionals in order to determine the cause of any nonconforming work and the necessary corrective action to bring the work into conformance with the requirements of the Contract Documents. Before commencing with the corrective work, the Contractor shall submit, in accordance with the General Conditions and Section 013300 "Submittal Procedures," complete description of the corrective work, including shop drawings and product data, for review by the Architect. This is solely for review of general conformance with the design concept expressed in the Contract Documents and shall not be deemed or construed to constitute approval of the corrective action or to relieve the Contractor of the responsibility to determine the proper course of action to correct the work.

13.2.7 The Contractor shall reimburse the Owner for all architectural and consultant fees relating to correction of any defect or deficiency in the Contractor's work. The fees shall be deducted in the form of a Construction Change Directive from the next scheduled payment to the Contractor. If the contract balances are insufficient to cover these fees, the Contractor agrees to reimburse the Owner within fifteen (15) days of the Owner's demand for reimbursement. This obligation shall survive the termination and/or completion of the Contractor's contract.

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13.3 **ACCEPTANCE OF DEFECTIVE OR NON-CONFORMING WORK**

13.3.1 If the Owner prefers to accept Work defective or non-conforming work, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 14

TERMINATION OF THE CONTRACT

14.1 **TERMINATION BY THE CONTRACTOR**

14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of thirty days under an order of any court or other public authority having jurisdiction, or as a result of an act of government, such as a declaration of a national emergency making materials unavailable, through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing any of the work under a contract with the Contractor, or if the work should be stopped for a period of thirty days by the Contractor for the Architect's failure to approve payment as provided in Article 9.3 or for the Owner's failure to make payment thereon as provided in Article 9.3, then the Contractor may, upon seven days' written notice to the Owner and the Architect, terminate the contract and recover from the Owner payment for all work executed and for any proven loss sustained upon any materials, equipment, tools, construction equipment and machinery, including reasonable profit.

14.2 **TERMINATION BY THE OWNER**

14.2.1 The Owner may terminate the Contract if the Contractor is adjudged as bankrupt, or if he makes a general assignment for the benefit of his creditors, or if a receiver is appointed on account of his insolvency, or if he persistently or repeatedly refuses or fails, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or if he fails to make prompt payment to Sub-contractors or for materials or labor, or persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or otherwise is guilty of a substantial violation of a provision of the Contract Documents, then the Owner, upon certification by the Architect that sufficient cause exists to justify such action, may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and his surety, if any, seven days' written notice, terminate the employment of the Contractor and take possession of the site and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor and may accept assignment of any subcontracts and may finish the work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the work is finished.

14.2.2 If the unpaid balance of the contract sum exceeds the costs of finishing the work, including compensation for the Architect's services and expenses, such excess shall be paid to the Contractor. If such costs exceed unpaid balance, the Contractor shall pay the difference to the Owner. The payment obligations contained in this section 14.2.2 shall survive termination of the Contract.

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14.2.3 In the event the Owner terminates the Contractor for cause, and such cause is determined to be valid and justified, in addition and without prejudice to all other rights, remedies and relief which Owner may obtain under the Contract Documents and pursuant to law, the Owner shall be entitled to payment by Contractor of reasonable attorneys' fees and legal costs. This provision shall create no right to the Contractor or to any other person or entity for payment of such costs or expenses.

14.3 **TERMINATION BY OWNER FOR CONVENIENCE**

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

14.3.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

14.3.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work completed by the Contractor in accordance with the Contract Documents. In case of such termination of the Contract for Owner's convenience, Contractor shall be entitled to receive payment from the Owner only for Work that has been certified by the Architect as having been completed by the Contractor.

14.4 **SUSPENSION BY OWNER FOR CONVENIENCE**

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

14.4.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Subparagraph 14.4.1. Adjustment to the Contract Sum shall include profit. No adjustment shall be made to the extent:

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

ARTICLE 15

STANDARDS

15.1 **STANDARDS**

15.1.1 Whenever a material, article or pieces of equipment is specified by reference to a governmental, trade association or similar standard, it shall comply with the requirements of the latest publication thereof and amendment thereto in effect on the bid date. Such standards are as effectively part of the Contract Documents as if therein printed.

ARTICLE 16

KNOWLEDGE OF CONTRACT REQUIREMENTS

16.1 **EXTENT OF WORK**

16.1.1 Each Contractor, Subcontractor, Sub-subcontractor and Materialmen shall consult in detail the General Conditions, all divisions and sections of the specifications, all drawings and all addenda for instructions and requirements pertaining to his work, and at his cost shall provide all labor, materials, equipment and services necessary to furnish, install and complete his work in strict conformance with all provisions thereof.

16.2 **EXAMINATION OF PREMISES**

16.2.1 Each Contractor will be held to have examined the site of the work prior to submitting his proposal and informed himself, his Subcontractor, Sub-subcontractors and Materialmen of all existing conditions affecting the prosecution of the work.

16.3 **SEPARATE CONTRACTS**

16.3.1 The Contractor will be held to have examined the Contract Documents, (and modifications thereto) for the separate contracts and informed himself, his Subcontractors, Sub-subcontractors and Materialmen of all conditions thereof affecting the prosecution of the work.

16.4 **LABOR**

16.4.1 The Contractor will be held to be thoroughly familiar with all conditions affecting labor in the neighborhood of the project including, but not limited to, union, incentive pay, procurement, living and commuting conditions and to have informed his Subcontractors and Sub-subcontractors thereof.

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ARTICLE 17

GOVERNMENT REQUIREMENTS

17.1 **CITIZENS**

17.1.1 Only citizens of the United States of America shall be employed in any capacity in the performance of any work under the contract; provided, however, that apprentices to a trade or profession who may be under twenty-one (21) years of age shall not be subject to the foregoing restriction.

17.2 **DISCRIMINATION PROHIBITED: According to 62 Pa. C.S.A. § 3701, the Contractor agrees that:**

17.2.1 In the hiring of employees for the manufacturer of supplies, performance of work under the contract or any subcontract, no Contractor, Subcontractor or any person acting on behalf of the Contractor or Subcontractor shall not by reason of gender, 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 employment relates.

17.2.2 Neither the Contractor nor any Subcontractor nor any person on their behalf shall in any manner discriminate against or intimidate any employee involved in the manufacture of supplies, the performance of the Work, or any other activity required under this Contract on account of gender, race, creed, or color against any subcontractor or supplier who is qualified to perform the Work under the Contract. The Contractor and subcontractors shall establish and maintain a written sexual harassment policy and shall inform their employees of the policy. The policy must contain a notice that sexual harassment will not be tolerated and employees who practice it will be disciplined. In addition, the Contractor shall include the provisions of this Nondiscrimination/Sexual Harassment Clause in every subcontract so that the provisions will be binding upon each subcontractor.

17.2.3 The contract may be canceled or terminated by the Owner and all money due or to become due under the contract may be forfeited for a violation of the terms or conditions of this paragraph.

17.3 **PENNSYLVANIA HUMAN RELATIONS ACT**

17.3.1 The provisions of the Pennsylvania Human Relations Act, Act 222 of October 27, 1955 P.L. 744, as amended from time to time (43 P.S. Section 951, et seq.) of the Commonwealth of Pennsylvania prohibit discrimination because of race, color, religious creed, ancestry, age, sex, national origin, handicap or disability, by employers, employment agencies, labor organizations, contractors and others. The Contractor shall agree to comply with the provisions of the Pennsylvania Human Relations Act, as amended from time to time that is made part of these General Conditions as if included herein at length. The Contractor's attention is directed to the language of the Commonwealth's non-discrimination clause in 16 PA. Code Section 49.101, et seq., as amended from time to time.

17.3.2 Your attention is directed to the language of the Commonwealth's non-discrimination clause in 16 PA. Code 49.101.

17.4 **STEEL PRODUCTS PROCUREMENT ACT**

17.4.1 As this Project involves the construction, reconstruction, alteration, repair, improvement or maintenance of “public work”, the Contractor shall strictly comply with all requirements of the Pennsylvania Steel Products Procurement Act, 73 P.S. Section 1881, et seq., with respect to the Work, which will shall include, without limitation, using steel, steel products (including machinery and equipment) or cast iron produced in the United States unless otherwise exempted therefrom.

17.4.2 In addition to the requirements set forth in Paragraph 17.4.1, the Contractor shall strictly comply with all requirements of the Trade Practices Act 71 P.S. § 773.101 et seq., which shall include, without limitation, being prohibited from using any aluminum or steel products made in a foreign country which discriminates against aluminum or steel products manufactured in Pennsylvania. The countries of Brazil, South Korea, Spain, and Argentina have been found to discriminate against certain products manufactured in Pennsylvania. Therefore, the purchase or use of those countries’ products, as listed herein, for the Project is strictly prohibited.

17.4.2 17.4.2.1 BRAZIL: Welded carbon steel pipes and tubes; carbon steel wire rods; tool steel; certain steel products, including hot-rolled stainless steel bar; stainless steel wire rod and cold-formed stainless steel bar; pre-stressed concrete steel wire strand; hot-rolled carbon steel plate in coil; hot-rolled carbon steel sheet and cold-rolled carbon steel sheets.

17.4.2.2 SPAIN: Certain stainless steel products, including stainless steel wire rod, hot-rolled stainless steel bars and cold-formed stainless steel bars; pre-stressed concrete steel wire strands certain steel products, including hot-rolled steel plate, cold-rolled carbon steel plate, carbon steel structural shapes, galvanized carbon steel sheet, hot-rolled carbon steel bars and cold-formed carbon steel bars.

17.4.2.3 SOUTH KOREA: Welded carbon steel pipes and tubes; hot-rolled carbon steel plate; hot-rolled carbon steel sheet and galvanized steel sheet.

17.4.2.4 ARGENTINA: Carbon steel wire rod and cold-rolled carbon steel sheet.

17.5 **SECTION 3301 OF THE PENNSYLVANIA COMMONWEALTH PROCUREMENT CODE**

17.5.1 Contractor shall comply with the provisions of Section 3301 of the Pennsylvania Commonwealth Procurement Code and regulations dealing with the prevention of environmental pollution and the preservation of public natural resources that affect the project. Refer to the list of statues and regulations in this specification following the prevailing wage rates. Comply with all Pennsylvania and Federal Statues listed in this Specification. Where any identified environmental statute, rule and/or regulation has been revised, amended, supplemented, replaced and/or supplanted, Contractor shall comply with such statute, rule and/or regulation as so modified. Notwithstanding the foregoing, failure to include any

GENERAL CONDITIONS OF THE CONTRACT - 45

applicable environmental statute, rule and/or regulation in the Contract Documents shall not relieve Contractor of its obligation to comply with the same.

17.6 **CONDITIONS OF PAYMENT OF WAGES**

17.6.1 Competent Workmen: Projects where the total estimated cost is \$25,000 or more are required to comply with the following:

17.6.2 According to section 752 of the Public School Code of 1949, no person shall be employed to do work under such contract except competent and first class workmen and mechanics.

17.6.2.1 Competent Workmen: No workmen shall be regarded as competent first class, within the meaning of this Act, except those who are duly skilled in their respective branches of labor, and who shall be paid not less than such rates of wages and for such hours work as shall be established and current rates of wages paid for such hours by employers of organized labor in doing of similar work in the Authority where work is being done.

17.7 **PREVAILING WAGE RATES**

17.7.1 The general prevailing minimum wage rates, including contributions for employee benefits as shall have been determined by the Secretary, must be paid to the workmen employed for the performance of this contract.

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

17.7.2.2 Such workmen shall be paid no less than such general prevailing minimum wage rates and such other provisions to assure payment thereof as hereinafter set forth in this section.

17.7.2.3 The contract provisions shall apply to all work performed on the contract by the Contractor and to all work performed on the contract by all Subcontractors.

17.7.2.4 The Contractor shall insert in each of his subcontracts all of the stipulations contained in these required provisions and such other stipulations as may be required.

17.7.2 No workers shall be employed on the Project except in accordance with the classifications set forth in the decision of the Secretary. In the event that additional or different classifications are necessary the procedure set forth in Section 9.105 of the regulations shall be followed.

GENERAL CONDITIONS OF THE CONTRACT - 46

17.7.3 All workers employed or working on the Project shall be paid unconditionally, regardless of whether any contractual relationship exists or the nature of any contractual relationship which may be alleged to exist between any Contractor, Subcontractor and workers, not less than once a week without deduction or rebate, on any account, either directly or indirectly, except authorized deductions, the full amount due at the time of payment, computed at the rates applicable to the time worked in the appropriate classification. Nothing in the Contract, or the Pennsylvania Prevailing Act shall prohibit the payment of more than the general prevailing minimum wage rates as determined by the Secretary to any workmen on public work.

17.7.4 The Contractor and each Subcontractor shall post for the entire period of construction the wage determination decisions of the Secretary, including without limitation the effective date of any changes thereof, in a prominent and easily accessible place or places at the site of the work and at such place or places used by them to pay workmen their wages. The posted notice of wage rates must contain the following information:

- 17.7.4.1 Name of project.
- 17.7.4.2 Name of public body of which it is being constructed.
- 17.7.4.3 The crafts and classifications of workmen listed in Secretary's general prevailing minimum wage rate determination for the particular project.
- 17.7.4.4 The general prevailing minimum wage rates determined for each craft and classification and the effective date of any changes.
- 17.7.4.5 A statement advising workmen that if they have been paid less than the general prevailing minimum wage rate for their job classification or that the Contractor and/or Subcontractor are not complying with the Act or these regulations in any manner whatsoever they may file a protest in writing with the Secretary of Labor & Industry within three (3) months of the date of the occurrence, objecting to the payment to any Contractor to the extent of the amount or amounts due or to become due to them as wages for work performed on the public work project. Any workmen paid less than the rate specified in the contract shall have a civil right of action for the difference between the wage paid and the wages stipulated in the contract, which right of action must be exercised within six (6) months from the occurrence of the event creating such right.

17.7.5 The Contractor and all Subcontractors shall keep an accurate record showing the name, craft and/or classification, number of hours worked per day, and the actual hourly rate of wage paid (including employee benefits) to each workmen employed by him in connection with the public work and such record must include any deductions from each workmen. The record shall be preserved for two years from the date of payment and shall be open at all reasonable hours to the inspection of the public body awarding the contract and to the Secretary or his duly authorized representative.

17.7.6 Apprentices shall be limited to such numbers as shall be in accordance with a bona fide apprenticeship program registered with and approved by the Pennsylvania Apprenticeship and Training Council and only apprentices whose training and employment are in full compliance with the provisions of the Apprenticeship and Training Act approved July 14, 1961 (Act No. 304) and the Rules & Regulations issued pursuant thereto, as amended from time to time, shall be employed on the Project. Any workers using the tools of a craft who does not qualify as an apprentice within the provisions of this submission shall be paid the rate predetermined for journeymen in that particular craft and/or classification.

GENERAL CONDITIONS OF THE CONTRACT - 47

17.7.7 Wages shall be paid without any deductions except authorized deductions. Employers not parties to a contract requiring contributions for employee benefits which the Secretary has determined to be included in the general prevailing minimum wage rates shall pay the monetary equivalent thereof directly to the workmen.

17.7.8 Payment of compensation to workers for work performed on public work on a lump sum basis, or a piece certain for the completion of a certain amount of work, or the production of a certain result shall be deemed a violation of the Prevailing Wage Act and these regulations, regardless of the average hourly earnings resulting therefrom.

17.7.9 Each Contractor and each Subcontractor shall file a statement which shall include their respective certified payrolls 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 workers have been paid wages in strict conformity with the provisions of the Contract as prescribed in the Pennsylvania Prevailing Wage Act, or if any wages remain unpaid to set forth the amount of wages due and owing to each workmen respectively. Payroll certifications shall not be mailed to the Architect.

17.7.10 Failure of the Contractor to comply with all the requirements of this Article will result in the withholding of payments to the Contractor.

17.8 **ASBESTOS - PCB (RIGHT TO KNOW LAW)**

17.8.1 No materials containing asbestos, asbestos products, polychlorinated biphenyl (PCB) or other toxic substances may be used in the construction. If requested, data sheets, as required by the Worker and Community Right-To-Know Act (P.L. 159, 1984) or by written verification from the material manufacturer stating that the material is asbestos-free or PCB-free must be furnished to the Owner and the Architect.

17.8.2 In the event a Contractor by virtue of his work for the Owner discovers asbestos, asbestos products, polychlorinated biphenyl (PCB) or other toxic substances, the Contractor must immediately notify the Owner and perform no further work in connection with said materials or substances, the Contractor must take all steps required by all federal, state, and local agencies regarding asbestos and/or toxic substance removal.

17.8.3 Asbestos and/or toxic substance removal operations may be the subject of a change order or a supplemental contract to this Contract, or separate contract to another contractor as the Owner may determine.

17.8.4 If a Contractor fails to meet the requirements of the federal, state and local regulations and these specifications related to the discovery, removal, and clean-up, the Contractor shall be subject to immediate termination and the Contractor shall be responsible for all costs and expenses related to the removal and clean-up of the asbestos and/or toxic substance including Architect and Engineering fees.

17.9 **IDENTIFICATION**

17.9.1 The Owner reserves the right to require all construction employees to be visually identified by the use of badges. In the event this security measure is implemented, the Owner will issue badges to all authorized employees in conjunction with the prime Contractors and record their issuance with names, addresses, etc. Termination of employment of the

GENERAL CONDITIONS OF THE CONTRACT - 48

construction employees will require the respective badges to be returned to the Owner for record keeping purposes. All employees must wear the badge on the job site. Employees without badges will not be permitted on the premises. The Architect will not have any responsibility in this matter.

17.11 **EMPLOYEE BACKGROUND CHECK**

17.11.1 All Contractors shall have background checks done on all employees and all Subcontractors' employees working on the Project. Background checks shall be in accordance with Act 34 of 1985, Section 111 of the Pennsylvania Public School Code of 1949, as amended. Background checks shall also be in accordance with Act 153 of 2002 which pertains to employees who are not residents of Pennsylvania and employees who have not been a resident of Pennsylvania for at least two (2) years immediately preceding the date of application for employment. The following clearances must be completed for all employees and all subcontractors' employees:

- A. Pennsylvania State Police - Request for Criminal Record Check: Form SP 4-164 is included in these specifications. There is a fee of \$10.00 per person.
- B. Arrest/Conviction Report and Certification Form: Form PDE-6004 is included in these specifications. It needs to be completed and returned to the School District. No fee is involved.
- C. Pennsylvania Child Abuse History Clearance: Form CY 113(UF) is included in these specifications. It needs to be completed and returned to the School District. There is a fee of \$10.00 per person.
- D. Commonwealth of PA Public Works Employment Verification Form: Form is included in these specifications. It needs to be completed and returned to the School District. No fee is involved.
- E. 'IdentoGO' Fingerprint Service Code Form: Form is included in these specifications. FBI Federal Criminal It needs to be completed and returned to the School District. No fee is involved.

17.11.2 Background Check Compliance:

- A. No personnel will be allowed on the School District's property without submission and approval of the above specified Personnel Background Check forms.
- B. Any form that expires during the contract period will require resubmission and approval. Any person that is not compliant will not be granted access on the School District's property. Failure to do so may result in a failure to process an application for payment during the occurrence.
- C. Any security costs incurred by the School District due to non-compliance of the specified Personnel Background Check, will be borne charged to the applicable Prime Contractor.

GENERAL CONDITIONS OF THE CONTRACT - 49

17.12 **UNDERGROUND UTILITY LINE PROTECTION LAW, ACT 287**

17.12.1 Contractor shall comply with the provisions and regulations of Act 287 of 1974, as amended by Act 50 of 2017 requires three working days notice to utilities prior to the start of any excavation, drilling, blasting or demolition. Act 50 requires all underground facility damages are to be documented and submitted to the PA 1 Call System via facility damage investigation form found on the PUC website or the PA 1 Call System website.

17.12.2 Use the “PA 1 Call System.” Telephone number: 1-800-242-1776.

17.12.3 Contractor shall be responsible to comply totally with the Act and at all times during the prosecution of the work of this contract.

17.13 **WORKMAN'S COMPENSATION ACT 44 OF 1993**

17.13.1 Each successful Prime Contractor will be required to obtain and complete an application complying with the "Workman's Compensation Act 44 of 1993" which became effective on September 1, 1993.

17.14 **AIR QUALITY CONCERNS AND REMEDIES**

17.14.1 The Contractor will be held responsible to fully comply with Sections 123.1 and 123.2 of the Rules and Regulations of the Department of Environmental Protection in respect to fugitive dust problems and the prompt removal of earth or other materials deposited onto paved roadways.

17.14.2 A brief requirement of the regulations that the Contractor must fully comply with is as follows:

17.14.2.1 Fugitive dust problems could result from the clearing of land and construction operations. Section 123.1 of the Rules and Regulations of the Department of Environmental Protection requires that all reasonable actions be taken to prevent particulate matter from becoming airborne. This regulation also calls for the use of water or chemicals for control of dust and the prompt removal of earth or other material deposited onto paved roadways. In addition, Section 123.2 prohibits the emission of fugitive particulate matter if the emissions are visible at the point the emissions pass onto adjacent property.

17.14.2.2 Any waste materials generated by construction or demolition operations must be handled and disposed of properly. No open burning of construction or demolition waste is permitted.

17.15 **AMERICANS WITH DISABILITIES ACT**

17.15.1 The Contractor understands and agrees that no individual with a disability shall, on the basis of the disability, be excluded from participation in this Contract or from activities provided for under this Contract. The Contractor agrees to comply with the "General

Prohibitions Against Discrimination", 28 C.F.R. Section 35.130, and all other regulations promulgated under Title II of the Americans with Disabilities Act.

17.14 **PENNSYLVANIA UNIFORM CONSTRUCTION CODE**

17.14.1 The Contractor shall comply with all requirements of the Pennsylvania Uniform Construction Code, 35 P.S. 7210.301 – 7210.304, as amended by S.B. 1139, Session of 2004, as further amended from time to time.

ARTICLE 18

CONTRACTOR'S UNDERSTANDING

18.1 The Contractor is required to examine carefully in detail, the character of the soil, the site of the project, the contract documents, and all other matters pertinent to the work contemplated. It will be assumed that he has satisfied himself as to the conditions to be encountered overhead, on the surface and underground, the character, quality and quantities of the work to be done, including materials to be furnished, and the requirements of the Contract Documents. No allowance or concession will be made for the lack of such information on the part of the Contractor. Where borings, test pits, test piles, and existing underground and overhead structure locations are shown, they are for the information of the Owner only; their correctness is not guaranteed by the Owner or the Architect, and in no event is this information to be considered a part of the contract, or to be used for computations in submitting a proposal. If this information is used by a bidder in preparing his proposal, he must assume all risks resulting from conditions differing from the approximation shown. If bidders desire to obtain such data, the Owner will, to the extent possible, afford them the opportunity, at their own expense, to make boring or soundings, to drive test piles, to dig test pits on the site of the work and to make measurements and studies of all kinds; where Owner cannot grant such rights, it will cooperate with Contractor in endeavoring to secure such rights.

18.2 There is no expressed or implied agreement that the depths, location or character of any materials have been correctly indicated and Contractor shall take into account that conditions affecting the cost or quantities of the work to be done may differ from those indicated.

18.3 Contractor shall ascertain all governmental and utility requirements with respect to wage scales, trench and structure excavations, tunnel construction, blasting equipment, materials, labor, safety and sanitation, and shall base his bid prices on full compliance therewith.

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

| | |
|----------------------------|--|
| Project Name: | Interior Alterations – Phase 3 Project for the Eastern Center for Arts and Technology Building |
| Awarding Agency: | Eastern Center for Arts and Technology |
| Contract Award Date: | 3/9/2022 |
| Serial Number: | 22-00783 |
| Project Classification: | Building |
| Determination Date: | 1/28/2022 |
| Assigned Field Office: | Philadelphia |
| Field Office Phone Number: | (215)560-1858 |
| Toll Free Phone Number: | |
| Project County: | Montgomery County |

PREVAILING MINIMUM WAGE DETERMINATION - 1

These Contract Documents have been prepared specifically for this Project and may only be used solely with respect to this Project. The Architect retains all common law, statutory, and other reserved rights, including copyright.

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

| Project: 22-00783 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|--|----------------|-----------------|-------------|-----------------|---------|
| Asbestos & Insulation Workers | 5/29/2017 | | \$47.30 | \$34.85 | \$82.15 |
| Asbestos & Insulation Workers | 5/1/2018 | | \$49.30 | \$35.85 | \$85.15 |
| Asbestos & Insulation Workers | 5/1/2019 | | \$51.20 | \$36.95 | \$88.15 |
| Asbestos & Insulation Workers | 6/1/2020 | | \$54.20 | \$36.95 | \$91.15 |
| Asbestos & Insulation Workers | 5/1/2021 | | \$54.35 | \$39.95 | \$94.30 |
| Boilermaker (Commercial, Institutional, and Minor Repair Work) | 3/1/2017 | | \$28.52 | \$18.22 | \$46.74 |
| Boilermaker (Commercial, Institutional, and Minor Repair Work) | 3/1/2018 | | \$29.52 | \$18.22 | \$47.74 |
| Boilermaker (Commercial, Institutional, and Minor Repair Work) | 1/1/2019 | | \$29.26 | \$18.48 | \$47.74 |
| Boilermakers | 1/1/2018 | | \$46.26 | \$33.36 | \$79.62 |
| Boilermakers | 3/1/2018 | | \$45.89 | \$33.73 | \$79.62 |
| Boilermakers | 1/1/2019 | | \$45.51 | \$34.11 | \$79.62 |
| Boilermakers | 8/1/2019 | | \$47.21 | \$34.11 | \$81.32 |
| Boilermakers | 1/1/2021 | | \$49.32 | \$34.90 | \$84.22 |
| Boilermakers | 1/1/2022 | | \$50.17 | \$35.30 | \$85.47 |
| Bricklayer | 5/1/2017 | | \$40.98 | \$26.78 | \$67.76 |
| Bricklayer | 5/1/2018 | | \$43.73 | \$26.78 | \$70.51 |
| Bricklayer | 5/1/2019 | | \$46.48 | \$26.78 | \$73.26 |
| Bricklayer | 5/1/2020 | | \$44.45 | \$30.31 | \$74.76 |
| Bricklayer | 5/1/2021 | | \$45.45 | \$30.61 | \$76.06 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2017 | | \$45.25 | \$27.59 | \$72.84 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2018 | 4/30/2019 | \$45.83 | \$27.59 | \$73.42 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2019 | 4/30/2020 | \$46.54 | \$27.59 | \$74.13 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2020 | | \$47.73 | \$27.59 | \$75.32 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2021 | | \$47.47 | \$28.71 | \$76.18 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2017 | | \$39.35 | \$27.59 | \$66.94 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2018 | 4/30/2019 | \$39.85 | \$27.59 | \$67.44 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2019 | 4/30/2020 | \$40.47 | \$27.59 | \$68.06 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2020 | | \$41.50 | \$27.59 | \$69.09 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2021 | | \$41.28 | \$28.71 | \$69.99 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2017 | | \$19.68 | \$19.64 | \$39.32 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2018 | 4/30/2019 | \$19.93 | \$19.49 | \$39.42 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2019 | 4/30/2020 | \$20.24 | \$19.69 | \$39.93 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2020 | | \$20.75 | \$19.49 | \$40.24 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2021 | | \$20.64 | \$20.31 | \$40.95 |
| Carpenters | 5/1/2017 | | \$39.35 | \$27.59 | \$66.94 |
| Carpenters | 5/1/2018 | 4/30/2019 | \$39.85 | \$27.59 | \$67.44 |
| Carpenters | 5/1/2019 | 4/30/2020 | \$40.87 | \$27.59 | \$68.46 |
| Carpenters | 5/1/2020 | | \$41.90 | \$27.59 | \$69.49 |
| Carpenters | 5/1/2021 | | \$41.28 | \$28.71 | \$69.99 |
| Carpenters | 5/1/2022 | | \$42.53 | \$28.71 | \$71.24 |
| Cement Masons | 5/1/2017 | | \$36.45 | \$31.76 | \$68.21 |
| Cement Masons | 5/1/2018 | | \$37.50 | \$32.26 | \$69.76 |

PREVAILING MINIMUM WAGE DETERMINATION - 2

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

| Project: 22-00783 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|---|-----------------------|------------------------|--------------------|------------------------|--------------|
| Cement Masons | 5/1/2019 | | \$38.50 | \$32.81 | \$71.31 |
| Cement Masons | 5/1/2020 | | \$39.45 | \$33.46 | \$72.91 |
| Cement Masons | 5/1/2021 | | \$40.70 | \$33.46 | \$74.16 |
| DockBuilder/ Divers (Building Heavy & Highway) | 5/1/2020 | | \$52.44 | \$37.27 | \$89.71 |
| DockBuilder/Pile Drivers (Building, Heavy & Highway) | 5/1/2018 | | \$43.45 | \$34.47 | \$77.92 |
| DockBuilder/Pile Drivers (Building, Heavy & Highway) | 5/1/2020 | | \$43.70 | \$37.27 | \$80.97 |
| DockBuilder/Pile Drivers/ Diver Tender(Building Heavy & Highway) | 5/1/2020 | | \$43.70 | \$37.27 | \$80.97 |
| Dockbuilder/Piledriver (Building, Heavy, Highway) | 11/1/2017 | | \$43.45 | \$33.22 | \$76.67 |
| Dockbuilder/Piledriver (Building, Heavy, Highway) | 5/1/2018 | | \$44.70 | \$33.22 | \$77.92 |
| Drywall Finisher | 5/1/2017 | | \$37.11 | \$26.75 | \$63.86 |
| Drywall Finisher | 5/1/2018 | 4/30/2019 | \$39.27 | \$27.49 | \$66.76 |
| Drywall Finisher | 5/1/2019 | | \$37.75 | \$28.11 | \$65.86 |
| Drywall Finisher | 5/1/2020 | | \$38.27 | \$28.59 | \$66.86 |
| Electricians | 4/30/2017 | | \$56.50 | \$36.24 | \$92.74 |
| Electricians | 4/29/2018 | | \$58.33 | \$37.41 | \$95.74 |
| Electricians | 4/29/2019 | | \$59.79 | \$38.95 | \$98.74 |
| Electricians | 8/2/2020 | | \$61.93 | \$40.31 | \$102.24 |
| Elevator Constructor | 1/1/2018 | | \$55.76 | \$33.05 | \$88.81 |
| Elevator Constructor | 1/1/2020 | | \$59.44 | \$35.25 | \$94.69 |
| Elevator Constructor | 1/1/2021 | | \$61.43 | \$36.36 | \$97.79 |
| Floor Coverer | 5/1/2019 | | \$44.37 | \$28.44 | \$72.81 |
| Floor Coverer | 5/1/2020 | | \$46.01 | \$28.44 | \$74.45 |
| Floor Coverer | 5/1/2021 | | \$45.74 | \$29.21 | \$74.95 |
| Floor Layer | 5/1/2017 | | \$42.51 | \$27.91 | \$70.42 |
| Floor Layer | 5/1/2018 | | \$43.11 | \$28.09 | \$71.20 |
| Glazier | 5/1/2017 | | \$41.30 | \$31.80 | \$73.10 |
| Glazier | 5/1/2018 | 4/30/2019 | \$43.32 | \$32.33 | \$75.65 |
| Glazier | 5/1/2019 | | \$43.87 | \$33.38 | \$77.25 |
| Glazier | 5/1/2020 | | \$44.92 | \$33.63 | \$78.55 |
| Glazier | 5/1/2021 | | \$45.67 | \$34.38 | \$80.05 |
| Interior Finish | 5/1/2019 | | \$30.20 | \$25.80 | \$56.00 |
| Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing) | 7/1/2017 | | \$47.30 | \$32.91 | \$80.21 |
| Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing) | 7/1/2018 | | \$51.46 | \$30.60 | \$82.06 |
| Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing) | 7/1/2019 | | \$49.30 | \$34.41 | \$83.71 |
| Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing) | 1/1/2020 | | \$49.80 | \$34.41 | \$84.21 |
| Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing) | 7/1/2020 | | \$50.80 | \$34.91 | \$85.71 |
| Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing) | 7/1/2021 | | \$47.70 | \$39.51 | \$87.21 |
| Iron Workers (Riggers) | 7/1/2017 | | \$39.83 | \$27.92 | \$67.75 |
| Ironworker (Rodman) | 7/1/2017 | | \$42.56 | \$29.30 | \$71.86 |
| Ironworker (Rodman) | 7/1/2018 | | \$42.88 | \$30.60 | \$73.48 |

PREVAILING MINIMUM WAGE DETERMINATION - 3

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

| Project: 22-00783 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|---|-----------------------|------------------------|--------------------|------------------------|--------------|
| Ironworker (Rodman) | 7/1/2019 | | \$43.88 | \$30.85 | \$74.73 |
| Ironworker (Rodman) | 7/1/2020 | | \$44.82 | \$31.60 | \$76.42 |
| Laborers (Class 01 - General) | 5/1/2020 | | \$32.05 | \$25.25 | \$57.30 |
| Laborers (Class 01 - See notes) | 5/1/2017 | | \$28.65 | \$24.95 | \$53.60 |
| Laborers (Class 01 - See notes) | 5/1/2019 | | \$31.65 | \$26.62 | \$58.27 |
| Laborers (Class 02 - See notes) | 5/1/2017 | | \$30.85 | \$25.65 | \$56.50 |
| Laborers (Class 02 - See notes) | 5/1/2019 | | \$33.15 | \$26.50 | \$59.65 |
| Laborers (Class 02 - see notes) | 5/1/2020 | | \$35.15 | \$26.15 | \$61.30 |
| Laborers (Class 03 - See notes) | 5/1/2017 | | \$28.92 | \$25.18 | \$54.10 |
| Laborers (Class 03 - See notes) | 5/1/2019 | | \$30.52 | \$25.98 | \$56.50 |
| Laborers (Class 03 - See notes) | 5/1/2020 | | \$32.47 | \$25.43 | \$57.90 |
| Laborers (Class 04 - See notes) | 5/1/2017 | | \$28.95 | \$24.95 | \$53.90 |
| Laborers (Class 04 - See notes) | 5/1/2019 | | \$30.52 | \$25.98 | \$56.50 |
| Laborers (Class 04 - See notes) | 5/1/2020 | | \$32.47 | \$25.43 | \$57.90 |
| Laborers (Class 05 - See notes) | 5/1/2017 | | \$28.65 | \$24.95 | \$53.60 |
| Laborers (Class 05 - See notes) | 5/1/2019 | | \$30.20 | \$25.80 | \$56.00 |
| Laborers (Class 05 - See notes) | 5/1/2020 | | \$32.05 | \$25.25 | \$57.30 |
| Landscape Laborer | 5/1/2017 | | \$22.71 | \$23.08 | \$45.79 |
| Landscape Laborer | 5/1/2019 | | \$24.64 | \$23.68 | \$48.32 |
| Landscape Laborer | 5/1/2020 | | \$26.55 | \$23.13 | \$49.68 |
| Marble Finisher | 5/1/2017 | | \$35.55 | \$24.17 | \$59.72 |
| Marble Finisher | 5/1/2018 | | \$37.55 | \$24.17 | \$61.72 |
| Marble Finisher | 5/1/2019 | | \$39.75 | \$24.17 | \$63.92 |
| Marble Finisher | 5/1/2020 | | \$37.57 | \$27.65 | \$65.22 |
| Marble Mason | 5/1/2017 | | \$40.36 | \$26.99 | \$67.35 |
| Marble Mason | 5/1/2018 | | \$43.11 | \$26.99 | \$70.10 |
| Marble Mason | 5/1/2019 | | \$45.86 | \$26.99 | \$72.85 |
| Marble Mason | 5/1/2020 | | \$44.25 | \$30.10 | \$74.35 |
| Mason Tender, Cement | 5/1/2019 | | \$30.52 | \$25.98 | \$56.50 |
| Millwright | 7/1/2017 | | \$41.35 | \$32.24 | \$73.59 |
| Millwright | 5/1/2018 | | \$43.33 | \$32.96 | \$76.29 |
| Millwright | 5/1/2019 | | \$45.50 | \$33.29 | \$78.79 |
| Millwright | 6/8/2020 | | \$46.80 | \$33.19 | \$79.99 |
| Millwright | 5/1/2021 | | \$48.60 | \$33.19 | \$81.79 |
| Millwright | 5/1/2022 | | \$50.60 | \$33.19 | \$83.79 |
| Operators (Building, Class 01 - See Notes) | 5/1/2017 | | \$44.87 | \$28.14 | \$73.01 |
| Operators (Building, Class 01 - See Notes) | 5/1/2018 | | \$46.41 | \$28.60 | \$75.01 |
| Operators (Building, Class 01 - See Notes) | 5/1/2019 | | \$46.41 | \$30.60 | \$77.01 |
| Operators (Building, Class 01 - See Notes) | 5/1/2020 | | \$47.96 | \$31.05 | \$79.01 |
| Operators (Building, Class 01 - See Notes) | 5/1/2021 | | \$49.50 | \$31.51 | \$81.01 |
| Operators (Building, Class 01A - See Notes) | 5/1/2017 | | \$47.86 | \$29.03 | \$76.89 |
| Operators (Building, Class 01A - See Notes) | 5/1/2018 | | \$49.41 | \$29.49 | \$78.90 |
| Operators (Building, Class 01A - See Notes) | 5/1/2019 | | \$49.41 | \$31.49 | \$80.90 |
| Operators (Building, Class 01A - See Notes) | 5/1/2020 | | \$50.96 | \$31.94 | \$82.90 |

PREVAILING MINIMUM WAGE DETERMINATION - 4

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

| Project: 22-00783 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|---|-----------------------|------------------------|--------------------|------------------------|--------------|
| Operators (Building, Class 01A - See Notes) | 5/1/2021 | | \$52.51 | \$32.39 | \$84.90 |
| Operators (Building, Class 02 - See Notes) | 5/1/2017 | | \$44.62 | \$28.07 | \$72.69 |
| Operators (Building, Class 02 - See Notes) | 5/1/2018 | | \$46.16 | \$28.53 | \$74.69 |
| Operators (Building, Class 02 - See Notes) | 5/1/2019 | | \$46.16 | \$30.53 | \$76.69 |
| Operators (Building, Class 02 - See Notes) | 5/1/2020 | | \$47.71 | \$30.98 | \$78.69 |
| Operators (Building, Class 02 - See Notes) | 5/1/2021 | | \$49.25 | \$31.44 | \$80.69 |
| Operators (Building, Class 02A - See Notes) | 5/1/2017 | | \$47.61 | \$28.97 | \$76.58 |
| Operators (Building, Class 02A - See Notes) | 5/1/2018 | | \$49.16 | \$29.42 | \$78.58 |
| Operators (Building, Class 02A - See Notes) | 5/1/2019 | | \$49.17 | \$31.41 | \$80.58 |
| Operators (Building, Class 02A - See Notes) | 5/1/2020 | | \$50.71 | \$31.87 | \$82.58 |
| Operators (Building, Class 02A - See Notes) | 5/1/2021 | | \$52.26 | \$32.32 | \$84.58 |
| Operators (Building, Class 03 - See Notes) | 5/1/2017 | | \$40.53 | \$26.87 | \$67.40 |
| Operators (Building, Class 03 - See Notes) | 5/1/2018 | | \$42.07 | \$27.33 | \$69.40 |
| Operators (Building, Class 03 - See Notes) | 5/1/2019 | | \$42.08 | \$29.32 | \$71.40 |
| Operators (Building, Class 03 - See Notes) | 5/1/2020 | | \$43.62 | \$29.78 | \$73.40 |
| Operators (Building, Class 03 - See Notes) | 5/1/2021 | | \$45.16 | \$30.24 | \$75.40 |
| Operators (Building, Class 04 - See Notes) | 5/1/2017 | | \$40.24 | \$26.78 | \$67.02 |
| Operators (Building, Class 04 - See Notes) | 5/1/2018 | | \$41.78 | \$27.22 | \$69.00 |
| Operators (Building, Class 04 - See Notes) | 5/1/2019 | | \$41.78 | \$29.23 | \$71.01 |
| Operators (Building, Class 04 - See Notes) | 5/1/2020 | | \$43.32 | \$29.69 | \$73.01 |
| Operators (Building, Class 04 - See Notes) | 5/1/2021 | | \$44.87 | \$30.14 | \$75.01 |
| Operators (Building, Class 05 - See Notes) | 5/1/2017 | | \$38.51 | \$26.27 | \$64.78 |
| Operators (Building, Class 05 - See Notes) | 5/1/2018 | | \$40.05 | \$26.73 | \$66.78 |
| Operators (Building, Class 05 - See Notes) | 5/1/2019 | | \$40.06 | \$28.72 | \$68.78 |
| Operators (Building, Class 05 - See Notes) | 5/1/2020 | | \$41.60 | \$29.18 | \$70.78 |
| Operators (Building, Class 05 - See Notes) | 5/1/2021 | | \$43.14 | \$29.64 | \$72.78 |
| Operators (Building, Class 06 - See Notes) | 5/1/2017 | | \$37.52 | \$25.98 | \$63.50 |
| Operators (Building, Class 06 - See Notes) | 5/1/2018 | | \$39.07 | \$26.43 | \$65.50 |
| Operators (Building, Class 06 - See Notes) | 5/1/2019 | | \$39.07 | \$28.43 | \$67.50 |
| Operators (Building, Class 06 - See Notes) | 5/1/2020 | | \$40.61 | \$28.89 | \$69.50 |
| Operators (Building, Class 06 - See Notes) | 5/1/2021 | | \$42.16 | \$29.34 | \$71.50 |
| Operators (Building, Class 07A- See Notes) | 5/1/2017 | | \$54.14 | \$32.47 | \$86.61 |
| Operators (Building, Class 07A- See Notes) | 5/1/2018 | | \$55.99 | \$33.02 | \$89.01 |
| Operators (Building, Class 07A- See Notes) | 5/1/2019 | | \$56.30 | \$35.11 | \$91.41 |
| Operators (Building, Class 07A- See Notes) | 5/1/2020 | | \$58.16 | \$35.65 | \$93.81 |
| Operators (Building, Class 07A- See Notes) | 5/1/2021 | | \$60.00 | \$36.21 | \$96.21 |
| Operators (Building, Class 07B- See Notes) | 5/1/2017 | | \$53.84 | \$32.40 | \$86.24 |
| Operators (Building, Class 07B- See Notes) | 5/1/2018 | | \$55.70 | \$32.92 | \$88.62 |
| Operators (Building, Class 07B- See Notes) | 5/1/2019 | | \$56.00 | \$35.03 | \$91.03 |
| Operators (Building, Class 07B- See Notes) | 5/1/2020 | | \$57.86 | \$35.57 | \$93.43 |
| Operators (Building, Class 07B- See Notes) | 5/1/2021 | | \$59.72 | \$36.11 | \$95.83 |
| Painters Class 1 (see notes) | 5/1/2021 | | \$41.24 | \$30.29 | \$71.53 |
| Painters Class 2 (see notes) | 2/1/2021 | | \$47.56 | \$29.35 | \$76.91 |
| Painters Class 4 (see notes) | 5/1/2021 | | \$41.62 | \$30.29 | \$71.91 |

PREVAILING MINIMUM WAGE DETERMINATION - 5

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

| Project: 22-00783 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|------------------------------|----------------|-----------------|-------------|-----------------|---------|
| Piledrivers | 5/1/2021 | | \$43.73 | \$37.99 | \$81.72 |
| Plasterers | 5/1/2017 | | \$37.42 | \$28.83 | \$66.25 |
| Plasterers | 5/1/2018 | | \$37.42 | \$30.04 | \$67.46 |
| Plasterers | 5/1/2019 | | \$37.72 | \$30.74 | \$68.46 |
| Plasterers | 5/1/2020 | | \$38.12 | \$31.34 | \$69.46 |
| Plasterers | 5/1/2021 | | \$38.37 | \$31.84 | \$70.21 |
| plumber | 5/1/2018 | 4/30/2019 | \$53.45 | \$33.54 | \$86.99 |
| plumber | 5/1/2019 | | \$55.45 | \$34.54 | \$89.99 |
| plumber | 8/1/2020 | | \$57.33 | \$35.66 | \$92.99 |
| plumber | 5/1/2021 | | \$59.83 | \$36.16 | \$95.99 |
| Plumbers | 5/1/2017 | | \$51.42 | \$32.57 | \$83.99 |
| Pointers, Caulkers, Cleaners | 5/1/2017 | | \$42.26 | \$25.69 | \$67.95 |
| Pointers, Caulkers, Cleaners | 5/1/2018 | | \$45.01 | \$25.69 | \$70.70 |
| Pointers, Caulkers, Cleaners | 5/1/2019 | | \$47.76 | \$25.69 | \$73.45 |
| Pointers, Caulkers, Cleaners | 5/1/2020 | | \$45.75 | \$29.20 | \$74.95 |
| Pointers, Caulkers, Cleaners | 5/1/2021 | | \$46.75 | \$29.50 | \$76.25 |
| Roofers (Composition) | 5/1/2017 | | \$36.15 | \$30.22 | \$66.37 |
| Roofers (Composition) | 5/1/2018 | | \$37.15 | \$31.27 | \$68.42 |
| Roofers (Composition) | 5/1/2019 | | \$38.35 | \$31.80 | \$70.15 |
| Roofers (Composition) | 5/1/2020 | | \$39.50 | \$32.30 | \$71.80 |
| Roofers (Composition) | 5/1/2021 | | \$40.33 | \$33.12 | \$73.45 |
| Roofers (Shingle) | 5/1/2016 | | \$25.70 | \$19.17 | \$44.87 |
| Roofers (Shingle) | 5/1/2019 | | \$28.50 | \$20.87 | \$49.37 |
| Roofers (Shingle) | 5/1/2020 | | \$29.50 | \$21.25 | \$50.75 |
| Roofers (Shingle) | 5/1/2021 | | \$30.50 | \$21.55 | \$52.05 |
| Roofers (Slate & Tile) | 5/1/2016 | | \$28.70 | \$19.17 | \$47.87 |
| Roofers (Slate & Tile) | 5/1/2018 | | \$30.50 | \$20.37 | \$50.87 |
| Roofers (Slate & Tile) | 5/1/2019 | | \$31.50 | \$20.87 | \$52.37 |
| Roofers (Slate & Tile) | 5/1/2020 | | \$32.50 | \$21.25 | \$53.75 |
| Roofers (Slate & Tile) | 5/1/2021 | | \$33.50 | \$21.55 | \$55.05 |
| Sheet Metal Workers | 5/1/2017 | | \$46.42 | \$39.51 | \$85.93 |
| Sheet Metal Workers | 5/1/2018 | | \$47.58 | \$41.60 | \$89.18 |
| Sheet Metal Workers | 5/1/2019 | | \$49.79 | \$42.89 | \$92.68 |
| Sheet Metal Workers | 5/1/2020 | | \$52.04 | \$44.19 | \$96.23 |
| Sheet Metal Workers | 5/1/2021 | | \$53.84 | \$45.94 | \$99.78 |
| Sign Makers and Hangars | 7/17/2021 | | \$29.49 | \$23.90 | \$53.39 |
| Sprinklerfitters | 4/1/2017 | | \$37.40 | \$21.74 | \$59.14 |
| Sprinklerfitters | 4/1/2018 | | \$38.80 | \$22.74 | \$61.54 |
| Sprinklerfitters | 5/1/2019 | | \$57.20 | \$28.32 | \$85.52 |
| Sprinklerfitters | 5/1/2020 | | \$59.10 | \$29.22 | \$88.32 |
| Sprinklerfitters | 5/1/2021 | | \$60.83 | \$30.34 | \$91.17 |
| Steamfitters | 5/1/2017 | | \$54.64 | \$32.53 | \$87.17 |
| Steamfitters | 5/1/2018 | | \$56.37 | \$34.39 | \$90.76 |
| Steamfitters | 5/1/2019 | | \$58.17 | \$35.99 | \$94.16 |

PREVAILING MINIMUM WAGE DETERMINATION - 6

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

| Project: 22-00783 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|---------------------------------|----------------|-----------------|-------------|-----------------|----------|
| Steamfitters | 5/1/2020 | | \$60.47 | \$37.24 | \$97.71 |
| Steamfitters | 5/1/2021 | | \$60.47 | \$40.89 | \$101.36 |
| Steamfitters | 5/1/2022 | | \$60.47 | \$44.63 | \$105.10 |
| Stone Masons | 5/1/2017 | | \$40.36 | \$26.99 | \$67.35 |
| Stone Masons | 5/1/2018 | | \$43.11 | \$26.99 | \$70.10 |
| Stone Masons | 5/1/2019 | | \$45.86 | \$26.99 | \$72.85 |
| Stone Masons | 5/1/2020 | | \$44.25 | \$30.10 | \$74.35 |
| Stone Masons | 5/1/2021 | | \$44.90 | \$30.75 | \$75.65 |
| Terrazzo Finisher | 5/1/2017 | | \$39.06 | \$22.73 | \$61.79 |
| Terrazzo Finisher | 5/1/2018 | | \$41.31 | \$22.73 | \$64.04 |
| Terrazzo Finisher | 5/1/2019 | | \$43.61 | \$22.73 | \$66.34 |
| Terrazzo Finisher | 5/1/2020 | | \$41.46 | \$26.37 | \$67.83 |
| Terrazzo Grinder | 5/1/2017 | | \$39.33 | \$22.73 | \$62.06 |
| Terrazzo Grinder | 5/1/2018 | | \$41.58 | \$22.73 | \$64.31 |
| Terrazzo Grinder | 5/1/2019 | | \$43.88 | \$22.73 | \$66.61 |
| Terrazzo Grinder | 5/1/2020 | | \$41.73 | \$26.37 | \$68.10 |
| Terrazzo Mechanics | 5/1/2017 | | \$43.71 | \$24.81 | \$68.52 |
| Terrazzo Mechanics | 5/1/2018 | | \$46.46 | \$24.81 | \$71.27 |
| Terrazzo Mechanics | 5/1/2019 | | \$49.21 | \$24.81 | \$74.02 |
| Terrazzo Mechanics | 5/1/2020 | | \$47.51 | \$28.01 | \$75.52 |
| Terrazzo Mechanics | 5/1/2021 | | \$48.01 | \$28.81 | \$76.82 |
| Tile Finisher | 5/1/2017 | | \$35.55 | \$24.17 | \$59.72 |
| Tile Finisher | 5/1/2018 | | \$37.55 | \$24.17 | \$61.72 |
| Tile Finisher | 5/1/2019 | | \$39.75 | \$24.17 | \$63.92 |
| Tile Finisher | 5/1/2020 | | \$37.57 | \$27.65 | \$65.22 |
| Tile Setter | 5/1/2017 | | \$43.71 | \$24.81 | \$68.52 |
| Tile Setter | 5/1/2018 | | \$46.46 | \$24.81 | \$71.27 |
| Tile Setter | 5/1/2019 | | \$49.21 | \$24.81 | \$74.02 |
| Tile Setter | 5/1/2020 | | \$47.51 | \$28.01 | \$75.52 |
| Truckdriver class 1 (see notes) | 5/1/2017 | | \$30.46 | \$17.96 | \$48.42 |
| Truckdriver class 1 (see notes) | 5/1/2018 | | \$31.93 | \$17.96 | \$49.89 |
| Truckdriver class 1 (see notes) | 5/1/2019 | | \$32.21 | \$19.19 | \$51.40 |
| Truckdriver class 1 (see notes) | 5/1/2020 | | \$34.93 | \$17.96 | \$52.89 |
| Truckdriver class 1 (see notes) | 5/1/2021 | | \$36.48 | \$17.96 | \$54.44 |
| Truckdriver class 2 (see notes) | 5/1/2017 | | \$30.56 | \$17.96 | \$48.52 |
| Truckdriver class 2 (see notes) | 5/1/2018 | | \$32.03 | \$17.96 | \$49.99 |
| Truckdriver class 2 (see notes) | 5/1/2019 | | \$32.31 | \$19.19 | \$51.50 |
| Truckdriver class 2 (see notes) | 5/1/2020 | | \$35.03 | \$17.96 | \$52.99 |
| Truckdriver class 2 (see notes) | 5/1/2021 | | \$36.58 | \$17.96 | \$54.54 |
| Truckdriver class 3 (see notes) | 5/1/2017 | | \$30.56 | \$17.96 | \$48.52 |
| Truckdriver class 3 (see notes) | 5/1/2018 | | \$32.28 | \$17.96 | \$50.24 |
| Truckdriver class 3 (see notes) | 5/1/2019 | | \$32.56 | \$19.19 | \$51.75 |
| Truckdriver class 3 (see notes) | 5/1/2020 | | \$35.28 | \$17.96 | \$53.24 |
| Truckdriver class 3 (see notes) | 5/1/2021 | | \$36.83 | \$17.96 | \$54.79 |

PREVAILING MINIMUM WAGE DETERMINATION - 7

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

| Project: 22-00783 - Building | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|-------------------------------------|-----------------------|------------------------|--------------------|------------------------|--------------|
| Window Film / Tint Installer | 6/1/2019 | | \$24.52 | \$12.08 | \$36.60 |

PREVAILING MINIMUM WAGE DETERMINATION - 8

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

| Project: 22-00783 - Heavy/Highway | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|---|----------------|-----------------|-------------|-----------------|---------|
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2017 | | \$51.42 | \$27.39 | \$78.81 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2018 | 4/30/2019 | \$53.20 | \$27.69 | \$80.89 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2019 | 4/30/2020 | \$54.98 | \$28.04 | \$83.02 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2020 | 4/30/2021 | \$57.22 | \$28.04 | \$85.26 |
| Carpenter - Chief of Party (Surveying & Layout) | 5/1/2021 | | \$59.93 | \$27.69 | \$87.62 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2017 | | \$44.71 | \$27.39 | \$72.10 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2018 | 4/30/2019 | \$46.26 | \$27.69 | \$73.95 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2019 | 4/30/2020 | \$47.81 | \$28.04 | \$75.85 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2020 | 4/30/2021 | \$49.76 | \$28.04 | \$77.80 |
| Carpenter - Instrument Person (Surveying & Layout) | 5/1/2021 | | \$52.11 | \$27.69 | \$79.80 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2017 | | \$35.77 | \$21.19 | \$56.96 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2018 | 4/30/2019 | \$37.01 | \$21.34 | \$58.35 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2019 | 4/30/2020 | \$38.25 | \$21.34 | \$59.59 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2020 | 4/30/2021 | \$39.81 | \$21.34 | \$61.15 |
| Carpenter - Rodman (Surveying & Layout) | 5/1/2021 | | \$41.69 | \$21.34 | \$63.03 |
| Carpenter | 5/1/2018 | 4/30/2019 | \$46.26 | \$27.69 | \$73.95 |
| Carpenter | 5/1/2019 | 4/30/2020 | \$47.81 | \$28.04 | \$75.85 |
| Carpenter | 5/1/2020 | | \$49.46 | \$28.34 | \$77.80 |
| Carpenter | 5/1/2021 | | \$51.76 | \$28.04 | \$79.80 |
| Cement Masons | 5/1/2017 | | \$34.45 | \$31.51 | \$65.96 |
| Cement Masons | 5/1/2018 | | \$35.65 | \$32.01 | \$67.66 |
| Cement Masons | 5/1/2019 | | \$37.90 | \$31.51 | \$69.41 |
| Cement Masons | 5/1/2020 | | \$37.95 | \$33.26 | \$71.21 |
| Cement Masons | 5/1/2021 | | \$39.65 | \$33.41 | \$73.06 |
| DockBuilder/ Divers (Building Heavy & Highway) | 5/1/2020 | | \$52.44 | \$37.27 | \$89.71 |
| DockBuilder/Pile Drivers/ Diver Tender(Building Heavy & Highway) | 5/1/2020 | | \$43.70 | \$37.27 | \$80.97 |
| Electric Lineman | 5/29/2017 | | \$52.60 | \$26.37 | \$78.97 |
| Electric Lineman | 5/28/2018 | | \$53.64 | \$27.45 | \$81.09 |
| Electric Lineman | 5/27/2019 | | \$54.66 | \$28.56 | \$83.22 |
| Electric Lineman | 6/1/2020 | | \$55.96 | \$29.76 | \$85.72 |
| Electric Lineman | 5/31/2021 | | \$57.93 | \$30.22 | \$88.15 |
| Electric Lineman | 5/30/2022 | | \$59.17 | \$31.48 | \$90.65 |
| Electric Lineman | 5/29/2023 | | \$60.48 | \$32.77 | \$93.25 |
| Electric Lineman | 6/3/2024 | | \$62.07 | \$33.96 | \$96.03 |
| Electricians | 6/1/2022 | | \$44.46 | \$23.06 | \$67.52 |
| Electricians | 6/1/2023 | | \$46.49 | \$23.06 | \$69.55 |
| Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing) | 1/1/2017 | | \$44.20 | \$31.26 | \$75.46 |
| Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing) | 7/1/2020 | | \$50.80 | \$34.91 | \$85.71 |
| Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing) | 7/1/2021 | | \$47.70 | \$39.51 | \$87.21 |
| Iron Workers | 7/1/2017 | | \$47.30 | \$32.91 | \$80.21 |
| Iron Workers | 7/1/2019 | | \$49.30 | \$34.41 | \$83.71 |
| Iron Workers | 1/1/2020 | | \$49.80 | \$34.41 | \$84.21 |

PREVAILING MINIMUM WAGE DETERMINATION - 9

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

| Project: 22-00783 - Heavy/Highway | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|--|-----------------------|------------------------|--------------------|------------------------|--------------|
| Ironworker (Rodman) | 7/1/2020 | | \$44.82 | \$31.60 | \$76.42 |
| Laborers (Class 01 - See notes) | 5/1/2017 | | \$29.75 | \$25.65 | \$55.40 |
| Laborers (Class 01 - See notes) | 5/1/2018 | | \$31.25 | \$25.65 | \$56.90 |
| Laborers (Class 01 - See notes) | 5/1/2019 | | \$31.95 | \$26.50 | \$58.45 |
| Laborers (Class 01 - See notes) | 5/1/2020 | | \$33.95 | \$26.15 | \$60.10 |
| Laborers (Class 01 - See notes) | 5/1/2021 | | \$36.20 | \$25.65 | \$61.85 |
| Laborers (Class 02 - See notes) | 5/1/2017 | | \$29.95 | \$25.65 | \$55.60 |
| Laborers (Class 02 - See notes) | 5/1/2018 | | \$31.45 | \$25.65 | \$57.10 |
| Laborers (Class 02 - See notes) | 5/1/2019 | | \$32.15 | \$26.50 | \$58.65 |
| Laborers (Class 02 - See notes) | 5/1/2020 | | \$34.15 | \$26.15 | \$60.30 |
| Laborers (Class 02 - See notes) | 5/1/2021 | | \$36.40 | \$25.65 | \$62.05 |
| Laborers (Class 03 - See notes) | 5/1/2017 | | \$29.95 | \$25.65 | \$55.60 |
| Laborers (Class 03 - See notes) | 5/1/2018 | | \$31.45 | \$25.65 | \$57.10 |
| Laborers (Class 03 - See notes) | 5/1/2019 | | \$32.15 | \$26.50 | \$58.65 |
| Laborers (Class 03 - See notes) | 5/1/2020 | | \$34.15 | \$26.15 | \$60.30 |
| Laborers (Class 03 - See notes) | 5/1/2021 | | \$36.40 | \$25.65 | \$62.05 |
| Laborers (Class 04 - See notes) | 5/1/2017 | | \$24.55 | \$25.65 | \$50.20 |
| Laborers (Class 04 - See notes) | 5/1/2018 | | \$26.05 | \$25.65 | \$51.70 |
| Laborers (Class 04 - See notes) | 5/1/2019 | | \$26.75 | \$26.50 | \$53.25 |
| Laborers (Class 04 - See notes) | 5/1/2020 | | \$28.75 | \$26.15 | \$54.90 |
| Laborers (Class 04 - See notes) | 5/1/2021 | | \$31.00 | \$25.65 | \$56.65 |
| Laborers (Class 05 - See notes) | 5/1/2017 | | \$30.60 | \$25.65 | \$56.25 |
| Laborers (Class 05 - See notes) | 5/1/2018 | | \$32.10 | \$25.65 | \$57.75 |
| Laborers (Class 05 - See notes) | 5/1/2019 | | \$32.80 | \$26.50 | \$59.30 |
| Laborers (Class 05 - See notes) | 5/1/2020 | | \$34.80 | \$26.15 | \$60.95 |
| Laborers (Class 05 - See notes) | 5/1/2021 | | \$37.05 | \$25.65 | \$62.70 |
| Laborers (Class 06 - See notes) | 5/1/2017 | | \$30.65 | \$25.65 | \$56.30 |
| Laborers (Class 06 - See notes) | 5/1/2018 | | \$32.15 | \$25.65 | \$57.80 |
| Laborers (Class 06 - See notes) | 5/1/2019 | | \$32.85 | \$26.50 | \$59.35 |
| Laborers (Class 06 - See notes) | 5/1/2020 | | \$34.85 | \$26.15 | \$61.00 |
| Laborers (Class 06 - See notes) | 5/1/2021 | | \$37.10 | \$25.65 | \$62.75 |
| Laborers (Class 07 - See notes) | 5/1/2017 | | \$30.50 | \$25.65 | \$56.15 |
| Laborers (Class 07 - See notes) | 5/1/2018 | | \$32.00 | \$25.65 | \$57.65 |
| Laborers (Class 07 - See notes) | 5/1/2019 | | \$32.70 | \$26.50 | \$59.20 |
| Laborers (Class 07 - See notes) | 5/1/2020 | | \$34.70 | \$26.15 | \$60.85 |
| Laborers (Class 07 - See notes) | 5/1/2021 | | \$36.95 | \$25.65 | \$62.60 |
| Laborers (Class 08 - See notes) | 5/1/2017 | | \$30.25 | \$25.65 | \$55.90 |
| Laborers (Class 08 - See notes) | 5/1/2018 | | \$31.75 | \$25.65 | \$57.40 |
| Laborers (Class 08 - See notes) | 5/1/2019 | | \$32.45 | \$26.50 | \$58.95 |
| Laborers (Class 08 - See notes) | 5/1/2020 | | \$34.45 | \$26.15 | \$60.60 |
| Laborers (Class 08 - See notes) | 5/1/2021 | | \$36.70 | \$25.65 | \$62.35 |
| Laborers (Class 09 - See notes) | 5/1/2017 | | \$30.10 | \$25.65 | \$55.75 |
| Laborers (Class 09 - See notes) | 5/1/2018 | | \$31.60 | \$25.65 | \$57.25 |
| Laborers (Class 09 - See notes) | 5/1/2019 | | \$32.30 | \$26.50 | \$58.80 |

PREVAILING MINIMUM WAGE DETERMINATION - 10

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

| Project: 22-00783 - Heavy/Highway | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|--|-----------------------|------------------------|--------------------|------------------------|--------------|
| Laborers (Class 09 - See notes) | 5/1/2020 | | \$34.30 | \$26.15 | \$60.45 |
| Laborers (Class 09 - See notes) | 5/1/2021 | | \$36.55 | \$25.65 | \$62.20 |
| Laborers (Class 10- See notes) | 5/1/2017 | | \$30.25 | \$25.65 | \$55.90 |
| Laborers (Class 10- See notes) | 5/1/2018 | | \$33.30 | \$25.65 | \$58.95 |
| Laborers (Class 10- See notes) | 5/1/2019 | | \$32.45 | \$26.50 | \$58.95 |
| Laborers (Class 10- See notes) | 5/1/2020 | | \$34.45 | \$26.15 | \$60.60 |
| Laborers (Class 10- See notes) | 5/1/2021 | | \$36.70 | \$25.65 | \$62.35 |
| Laborers (Class 11 -See Notes) | 5/1/2017 | | \$30.15 | \$25.65 | \$55.80 |
| Laborers (Class 11 -See Notes) | 5/1/2018 | | \$31.55 | \$25.65 | \$57.20 |
| Laborers (Class 11 -See Notes) | 5/1/2019 | | \$32.35 | \$26.50 | \$58.85 |
| Laborers (Class 11 -See Notes) | 5/1/2020 | | \$34.35 | \$26.15 | \$60.50 |
| Laborers (Class 11 -See Notes) | 5/1/2021 | | \$36.50 | \$25.65 | \$62.15 |
| Laborers (Class 12 -See Notes) | 5/1/2017 | | \$31.85 | \$25.65 | \$57.50 |
| Laborers (Class 12 -See Notes) | 5/1/2018 | | \$32.45 | \$25.65 | \$58.10 |
| Laborers (Class 12 -See Notes) | 5/1/2019 | | \$34.05 | \$26.50 | \$60.55 |
| Laborers (Class 12 -See Notes) | 5/1/2020 | | \$36.05 | \$26.15 | \$62.20 |
| Laborers (Class 12 -See Notes) | 5/1/2021 | | \$37.40 | \$25.65 | \$63.05 |
| Laborers (Class 13 -See Notes) | 5/1/2017 | | \$33.88 | \$25.65 | \$59.53 |
| Laborers (Class 13 -See Notes) | 5/1/2018 | | \$35.38 | \$25.65 | \$61.03 |
| Laborers (Class 13 -See Notes) | 5/1/2019 | | \$36.08 | \$26.50 | \$62.58 |
| Laborers (Class 13 -See Notes) | 5/1/2020 | | \$38.08 | \$26.15 | \$64.23 |
| Laborers (Class 13 -See Notes) | 5/1/2021 | | \$40.33 | \$25.65 | \$65.98 |
| Laborers (Class 14 -See Notes) | 5/1/2017 | | \$30.00 | \$25.65 | \$55.65 |
| Laborers (Class 14 -See Notes) | 5/1/2018 | | \$31.50 | \$25.65 | \$57.15 |
| Laborers (Class 14 -See Notes) | 5/1/2019 | | \$32.20 | \$26.50 | \$58.70 |
| Laborers (Class 14 -See Notes) | 5/1/2020 | | \$34.20 | \$26.15 | \$60.35 |
| Laborers (Class 14 -See Notes) | 5/1/2021 | | \$36.45 | \$25.65 | \$62.10 |
| Laborers Utility (PGW ONLY) (Flagperson) | 5/1/2017 | | \$23.52 | \$17.58 | \$41.10 |
| Laborers Utility (PGW ONLY) | 5/1/2017 | | \$30.55 | \$17.58 | \$48.13 |
| Landscape Laborer | 4/1/2016 | | \$21.19 | \$22.65 | \$43.84 |
| Landscape Laborer | 5/1/2019 | | \$24.22 | \$23.50 | \$47.72 |
| Landscape Laborer | 5/1/2020 | | \$26.13 | \$22.95 | \$49.08 |
| Operators Class 01 - See Notes (Building, Heavy, Highway) | 5/1/2017 | | \$44.87 | \$28.14 | \$73.01 |
| Operators Class 01 - See Notes (Building, Heavy, Highway) | 5/1/2018 | | \$46.41 | \$28.60 | \$75.01 |
| Operators Class 01 - See Notes (Building, Heavy, Highway) | 5/1/2019 | | \$46.41 | \$30.60 | \$77.01 |
| Operators Class 01 - See Notes (Building, Heavy, Highway) | 5/1/2020 | | \$47.96 | \$31.20 | \$79.16 |
| Operators Class 01 - See Notes (Building, Heavy, Highway) | 5/1/2021 | | \$49.50 | \$31.51 | \$81.01 |
| Operators Class 01a - See Notes (Building, Heavy, Highway) | 5/1/2017 | | \$47.86 | \$29.03 | \$76.89 |
| Operators Class 01a - See Notes (Building, Heavy, Highway) | 5/1/2018 | | \$49.41 | \$29.49 | \$78.90 |
| Operators Class 01a - See Notes (Building, Heavy, Highway) | 5/1/2019 | | \$49.41 | \$31.49 | \$80.90 |

PREVAILING MINIMUM WAGE DETERMINATION - 11

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

| Project: 22-00783 - Heavy/Highway | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|--|-----------------------|------------------------|--------------------|------------------------|--------------|
| Highway) | | | | | |
| Operators Class 01a - See Notes (Building, Heavy, Highway) | 5/1/2020 | | \$50.96 | \$32.09 | \$83.05 |
| Operators Class 01a - See Notes (Building, Heavy, Highway) | 5/1/2021 | | \$52.51 | \$32.39 | \$84.90 |
| Operators Class 02 - See Notes (Building, Heavy, Highway) | 5/1/2017 | | \$44.62 | \$28.07 | \$72.69 |
| Operators Class 02 - See Notes (Building, Heavy, Highway) | 5/1/2018 | | \$46.16 | \$28.53 | \$74.69 |
| Operators Class 02 - See Notes (Building, Heavy, Highway) | 5/1/2019 | | \$46.16 | \$30.53 | \$76.69 |
| Operators Class 02 - See Notes (Building, Heavy, Highway) | 5/1/2020 | | \$47.71 | \$31.13 | \$78.84 |
| Operators Class 02 - See Notes (Building, Heavy, Highway) | 5/1/2021 | | \$49.25 | \$31.44 | \$80.69 |
| Operators Class 02a - See Notes (Building, Heavy, Highway) | 5/1/2017 | | \$47.61 | \$28.97 | \$76.58 |
| Operators Class 02a - See Notes (Building, Heavy, Highway) | 5/1/2018 | | \$49.16 | \$29.42 | \$78.58 |
| Operators Class 02a - See Notes (Building, Heavy, Highway) | 5/1/2019 | | \$49.17 | \$31.41 | \$80.58 |
| Operators Class 02a - See Notes (Building, Heavy, Highway) | 5/1/2020 | | \$50.71 | \$32.02 | \$82.73 |
| Operators Class 02a - See Notes (Building, Heavy, Highway) | 5/1/2021 | | \$52.27 | \$32.31 | \$84.58 |
| Operators Class 03 - See Notes (Building, Heavy, Highway) | 5/1/2017 | | \$40.53 | \$26.87 | \$67.40 |
| Operators Class 03 - See Notes (Building, Heavy, Highway) | 5/1/2018 | | \$42.07 | \$27.33 | \$69.40 |
| Operators Class 03 - See Notes (Building, Heavy, Highway) | 5/1/2019 | | \$42.08 | \$29.32 | \$71.40 |
| Operators Class 03 - See Notes (Building, Heavy, Highway) | 5/1/2020 | | \$43.62 | \$29.93 | \$73.55 |
| Operators Class 03 - See Notes (Building, Heavy, Highway) | 5/1/2021 | | \$45.16 | \$30.24 | \$75.40 |
| Operators Class 04 - See Notes (Building, Heavy, Highway) | 5/1/2017 | | \$40.24 | \$26.78 | \$67.02 |
| Operators Class 04 - See Notes (Building, Heavy, Highway) | 5/1/2018 | | \$41.78 | \$27.22 | \$69.00 |
| Operators Class 04 - See Notes (Building, Heavy, Highway) | 5/1/2019 | | \$41.78 | \$29.23 | \$71.01 |
| Operators Class 04 - See Notes (Building, Heavy, Highway) | 5/1/2020 | | \$43.32 | \$29.84 | \$73.16 |
| Operators Class 04 - See Notes (Building, Heavy, Highway) | 5/1/2021 | | \$44.86 | \$30.15 | \$75.01 |
| Operators Class 05 - See Notes (Building, Heavy, Highway) | 5/1/2017 | | \$38.51 | \$26.27 | \$64.78 |
| Operators Class 05 - See Notes (Building, Heavy, Highway) | 5/1/2018 | | \$40.05 | \$26.73 | \$66.78 |
| Operators Class 05 - See Notes (Building, Heavy, Highway) | 5/1/2019 | | \$40.06 | \$28.72 | \$68.78 |
| Operators Class 05 - See Notes (Building, Heavy, Highway) | 5/1/2020 | | \$41.60 | \$29.33 | \$70.93 |

PREVAILING MINIMUM WAGE DETERMINATION - 12

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

| Project: 22-00783 - Heavy/Highway | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|---|-----------------------|------------------------|--------------------|------------------------|--------------|
| Operators Class 05 - See Notes (Building, Heavy, Highway) | 5/1/2021 | | \$43.14 | \$29.64 | \$72.78 |
| Operators Class 06 - See Notes (Building, Heavy, Highway) | 5/1/2017 | | \$37.52 | \$25.98 | \$63.50 |
| Operators Class 06 - See Notes (Building, Heavy, Highway) | 5/1/2018 | | \$39.07 | \$26.43 | \$65.50 |
| Operators Class 06 - See Notes (Building, Heavy, Highway) | 5/1/2019 | | \$39.07 | \$28.43 | \$67.50 |
| Operators Class 06 - See Notes (Building, Heavy, Highway) | 5/1/2020 | | \$40.61 | \$29.04 | \$69.65 |
| Operators Class 06 - See Notes (Building, Heavy, Highway) | 5/1/2021 | | \$42.16 | \$29.34 | \$71.50 |
| Operators Class 07 (A) - See Notes (Building, Heavy, Highway) | 5/1/2017 | | \$54.14 | \$32.47 | \$86.61 |
| Operators Class 07 (A) - See Notes (Building, Heavy, Highway) | 5/1/2018 | | \$55.99 | \$33.02 | \$89.01 |
| Operators Class 07 (A) - See Notes (Building, Heavy, Highway) | 5/1/2019 | | \$56.30 | \$35.11 | \$91.41 |
| Operators Class 07 (A) - See Notes (Building, Heavy, Highway) | 5/1/2020 | | \$58.16 | \$35.80 | \$93.96 |
| Operators Class 07 (A) - See Notes (Building, Heavy, Highway) | 5/1/2021 | | \$60.00 | \$36.21 | \$96.21 |
| Operators Class 07 (B) - See Notes (Building, Heavy, Highway) | 5/1/2017 | | \$53.84 | \$32.40 | \$86.24 |
| Operators Class 07 (B) - See Notes (Building, Heavy, Highway) | 5/1/2018 | | \$55.70 | \$32.92 | \$88.62 |
| Operators Class 07 (B) - See Notes (Building, Heavy, Highway) | 5/1/2019 | | \$56.00 | \$35.03 | \$91.03 |
| Operators Class 07 (B) - See Notes (Building, Heavy, Highway) | 5/1/2020 | | \$57.86 | \$35.72 | \$93.58 |
| Operators Class 07 (B) - See Notes (Building, Heavy, Highway) | 5/1/2021 | | \$59.72 | \$36.11 | \$95.83 |
| Painters Class 2 (see notes) | 2/1/2021 | | \$47.56 | \$29.35 | \$76.91 |
| Painters Class 3 (see notes) | 2/1/2021 | | \$58.52 | \$29.39 | \$87.91 |
| Piledrivers | 5/1/2021 | | \$43.73 | \$37.99 | \$81.72 |
| Steamfitters (Heavy and Highway - Gas Distribution) | 5/1/2017 | | \$51.91 | \$32.53 | \$84.44 |
| Steamfitters (Heavy and Highway - Gas Distribution) | 5/1/2020 | | \$60.47 | \$36.93 | \$97.40 |
| Steamfitters | 5/1/2018 | | \$56.37 | \$34.39 | \$90.76 |
| Truckdriver class 1(see notes) | 5/1/2017 | | \$30.31 | \$17.96 | \$48.27 |
| Truckdriver class 1(see notes) | 5/1/2018 | | \$31.78 | \$17.96 | \$49.74 |
| Truckdriver class 1(see notes) | 5/1/2019 | | \$32.06 | \$19.19 | \$51.25 |
| Truckdriver class 1(see notes) | 5/1/2020 | | \$34.78 | \$17.96 | \$52.74 |
| Truckdriver class 1(see notes) | 5/1/2021 | | \$36.33 | \$17.96 | \$54.29 |
| Truckdriver class 2 (see notes) | 5/1/2017 | | \$30.41 | \$17.96 | \$48.37 |
| Truckdriver class 2 (see notes) | 5/1/2018 | | \$31.88 | \$17.96 | \$49.84 |
| Truckdriver class 2 (see notes) | 5/1/2019 | | \$32.16 | \$19.19 | \$51.35 |
| Truckdriver class 2 (see notes) | 5/1/2020 | | \$34.88 | \$17.96 | \$52.84 |
| Truckdriver class 2 (see notes) | 5/1/2021 | | \$36.43 | \$17.96 | \$54.39 |
| Truckdriver class 3 (see notes) | 5/1/2017 | | \$30.66 | \$17.96 | \$48.62 |
| Truckdriver class 3 (see notes) | 5/1/2018 | | \$32.13 | \$17.96 | \$50.09 |

PREVAILING MINIMUM WAGE DETERMINATION - 13

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

| Project: 22-00783 - Heavy/Highway | Effective Date | Expiration Date | Hourly Rate | Fringe Benefits | Total |
|--|-----------------------|------------------------|--------------------|------------------------|--------------|
| Truckdriver class 3 (see notes) | 5/1/2019 | | \$32.41 | \$19.19 | \$51.60 |
| Truckdriver class 3 (see notes) | 5/1/2020 | | \$35.13 | \$17.96 | \$53.09 |
| Truckdriver class 3 (see notes) | 5/1/2021 | | \$36.68 | \$17.96 | \$54.64 |

PREVAILING MINIMUM WAGE DETERMINATION - 14

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<https://www.dli.pa.gov/Individuals/Labor-Management-Relations/lc/prevaling-wage/Pages/Debarments-and-Settlements.aspx>

Debarments and Settlements

This notice is published for the information and convenience of public bodies subject to the Act.

Settlements

None at this time.

Debarments

Under Section 11(e) of the Act (43 P.S. § 165-1(e)), these persons and firms, or any firm, corporation or partnership in which such persons and firms have an interest, **shall be awarded no contract for 3 years after the date listed.**



CONTACT US
(HTTP://WWW.DLI.PA.GOV/PAGES/CONTACT-US.ASPX#.V2L5A7GRJHE)

CURRENT PREVAILING WAGE ACT DEBARMENTS - 1

**Interior Alterations – Phase 3
Eastern Center for Arts and Technology**

Commission Number 694

| CONTRACTOR | ADDRESS | DATE OF DEBARMENT |
|--|---|-------------------|
| Dewatering Services, LLC and Dennis Gold, Individually | 215 Big Oaks Drive, Franklin, PA 163236 | 11/28/2020 |
| ShIPLEY Brothers Construction, Inc. and Frank L. Shipley, Individually | 8037 Rowan Road, Cranberry Township, PA 1606 | 11/7/2020 |
| Cook's Service Co., Inc. and Stephin R. Cook, Robert R. Cook, Brock Cook, Christopher L. Cook, Individually | 300 Industrial Drive, Avondale, PA 19311 | 10/31/2020 |
| Ward Building Construction, LLC and Scott Ward, Individually | 3147 Jessica Road, Dover, PA 17315 | 12/6/2019 |
| Weber Construction, LLC and Keith Weber, Individually | 1502 Salssfras Street Erie, PA 16502 | 4/11/2019 |
| MD Gill Flooring & Floorforce, LLC and Lawrence Gill Individually | 2 East Highland Road Parkesburg, PA 19365 | 11/28/2018 |

CURRENT PREVAILING WAGE ACT DEBARMENTS - 2

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**"PENNSYLVANIA PREVAILING WAGE ACT"
Act of 1961, P.L. 987, No. 442**

PENNSYLVANIA PREVAILING WAGE ACT - 1

**"PENNSYLVANIA PREVAILING WAGE ACT"
Act of 1961, P.L. 987, No. 442**

AN ACT

Relating to public works contracts; providing for prevailing wage; imposing duties upon the Secretary of Labor and Industry; providing remedies, penalties and repealing existing laws.

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

Section 1. Short Title.

This act shall be known and may be cited as the "Pennsylvania Prevailing Wage Act."

Section 2. Definitions.

As used in this act —

(1) "Department" means Department of Labor and Industry of the Commonwealth of Pennsylvania.

(2) "Locality" means any political subdivision, or combination of the same, within the county in which the public work is to be performed. When no workmen for which a prevailing minimum wage is to be determined hereunder are employed in the locality, the locality may be extended to include adjoining political subdivisions where such workmen are employed in those crafts or trades for which there are no workmen employed in the locality as otherwise herein defined.

((2) amended Aug. 9, 1963, P.L. 653, No. 342)

(3) "Maintenance work" means the repair of existing facilities when the size, type or extent of such facilities is not thereby changed or increased.

(4) "Public body" means the Commonwealth of Pennsylvania, any of its political subdivisions, any authority created by the General Assembly of the Commonwealth of Pennsylvania and any instrumentality or agency of the Commonwealth of Pennsylvania.

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

((5) amended Aug. 9, 1963, P.L. 653, No. 342)

(6) "Secretary" means the Secretary of Labor and Industry or his duly authorized deputy or representative.

(7) "Workman" includes laborer, mechanic, skilled and semiskilled laborer and apprentices employed by any contractor or subcontractor and engaged in the performance of services directly upon the public work project, regardless of whether their work becomes a component part thereof, but does not include material suppliers or their employees who do not perform services at the job site.

(8) "Work performed under a rehabilitation program," means work arranged by and at a State institution primarily for teaching and upgrading the skills and employment opportunities of the inmates of such institutions.

(9) "Advisory Board" means the board created by section 2.1 of this act.

PENNSYLVANIA PREVAILING WAGE ACT - 2

((9) added Aug. 9, 1963, P.L. 653, No. 342)

(10) "Appeals Board" means the board created by section 2.2 of this act.

((10) added Aug. 9, 1963, P.L. 653, No. 342)

Section 2.1. Advisory Board, Powers and Duties.

(a) There is hereby created in the Department of Labor and Industry an Advisory Board consisting of seven members for the purpose of assisting the secretary in carrying out his duties under the act to which this is an amendment.

(b) Except for the member employed by the secretary, each member of the Advisory Board shall be appointed by the Governor and shall receive a compensation of thirty dollars (\$30) per day for each day actually spent in the performance of this duties plus necessary expenses.

(c) Of the seven members, one shall be a representative of an association of general contractors engaged full-time in the building construction industry, one shall be a representative of an association of heavy and highway construction industry, one shall be a member of an historically established union representing labor in the building construction industry, one shall be a member of an historically established union representing labor in the heavy and highway construction industry, one shall be a member of an association representing a political subdivision, one shall be learned in the law and employed by the secretary, and one shall not be engaged in or employed by the building industry or by a public body but shall represent the general public.

(d) At least two weeks' public notice shall be given in the manner prescribed by regulation of the board prior to any meeting of the board. Four members of the board shall constitute a quorum.

(e) The Advisory Board shall have the power and duty to —

(1) Consult with the secretary at his request concerning any matter arising under the administration of this act.

(2) Advise and assist the secretary in carrying out the duties provided for him by section 7 of this act.

(3) Promulgate rules and regulations necessary to carry out the duties placed upon the board by this act.

(2.1 added Aug. 9, 1963, P.L. 653, No. 342)

Section 2.2. Appeals Board Powers and Duties.

(a) There is hereby created in the Department of Labor and Industry an Appeals Board consisting of seven members for the purpose of hearing and determining grievances arising out of the administration of the act to which this is an amendment.

(b) Except for the member employed by the secretary, each member of the Appeals Board shall be appointed by the Governor and shall receive a compensation of thirty dollars (\$30) per day for each day actually spent in the performance of his duties plus necessary expenses.

(c) Of the seven members, one shall be a representative of an association of general contractors engaged full-time in the building construction industry, one shall be a representative of an association of heavy and highway contractors engaged full time in the heavy and highway construction industry, one shall be a member of an historically established union representing labor in the building construction industry, one shall be a member of an historically established union representing labor in the heavy

and highway construction industry, one shall be a member of an association representing a political subdivision, one shall be learned in the law and employed by the secretary, and one shall not be engaged in or employed by the building industry or by a public body but shall represent the general public. No member of the Advisory Board created by this amendatory act shall be appointed to the Appeals Board.

(d) Four members of the board shall constitute a quorum and the board shall neither sit for purposes of hearing any grievance nor make any determination unless a quorum is present.

(e) The Appeals Board shall have the power and duty to —

(1) Hear and determine any grievance or appeal arising out of the administration of this act.

(2) Promulgate rules and regulations necessary to carry out the duties placed upon the board by this act: Provided, however, That any such rules and regulations shall provide for notice of filing of grievances and appeals, public hearings, right of representation and all other procedures required by due process of law.

(2.2 added Aug. 9, 1963, P.L. 653, No. 342)

Section 3. Specifications.

The specifications for every contract for any public work to which any public body is a party, shall contain a provision stating the minimum wage rate that must be paid to the workmen employed in the performance of the contract.

(3 amended Aug. 9, 1963, P.L. 653, No. 342)

Section 4. Duty of Public Body.

It shall be the duty of every public body which proposes the making of a contract for any project of public work to determine from the secretary the prevailing minimum wage rates which shall be paid by the contractor to the workmen upon such project. Reference to such prevailing minimum rates shall be published in the notice issued for the purpose of securing bids for such project of public work. Whenever any contract for a project of public work is entered into, the prevailing minimum wages as determined by the secretary shall be incorporated into and made a part of such contract and shall not be altered during the period such contract is in force.

(4 amended Aug. 9, 1963, P.L. 653, No. 342)

Section 5. Prevailing Wage.

Not less than the prevailing minimum wages as determined hereunder shall be paid to all workmen employed on public work.

(5 amended Aug. 9, 1963, P.L. 653, No. 342)

Section 6. Duty of Contractor.

Every contractor and subcontractor shall keep an accurate record showing the name, craft and the actual hourly rate of wage paid to each workman employed by him in connection with public work, and such record shall be preserved for two years from date of payment. The record shall be open at all reasonable hours to the inspection of the public body awarding the contract and to the secretary.

Section 7. Duty of Secretary.

The secretary shall, after consultation with the advisory board, determine the general prevailing

minimum wage rate in the locality in which the public work is to be performed for each craft or classification of all workmen needed to perform public work contracts during the anticipated term thereof: Provided, however, That employer and employe contributions for employe benefits pursuant to a bona fide collective bargaining agreement shall be considered an integral part of the wage rate for the purpose of determining the minimum wage rate under this act. Nothing in the act, however, shall prohibit the payment of more than the general prevailing minimum wage rate to any workman employed on public work. The secretary shall forthwith give notice by mail of all determinations of general prevailing minimum wage rates made pursuant to this section to any representative of any craft, any employer or any representative of any group of employers, who shall in writing request the secretary so to do.

(7 amended Aug. 9, 1963, P.L. 653, No. 342)

Section 8. Review of Rates, Petition and Hearing.

Any prospective bidder or his representative, any representative of any group of employers engaged in the particular type of construction, reconstruction, alteration and demolition or repair work involved, any representative of any craft or classification of workmen or the public body may, within ten days after the publication and issue of the specifications covering the particular contract for public work involved, file with the secretary a verified petition to review the determination of any such rate or rates. Within two days thereafter a copy of such petition shall be filed with the public body authorizing the public work. The petition shall set forth the facts upon which it is based. The secretary shall, upon notice to the petitioner, the public body authorizing the public work and the recognized collective bargaining representatives for the particular crafts and classifications involved, and also to all persons entitled to receive notice pursuant to subsection (a) of section 7 hereof, institute an investigation and hold a public hearing within twenty days after the filing of such petition. Within ten days thereafter, the secretary shall make a determination and transmit it, in writing, to the public body and to the interested parties. Such determination shall be final unless within ten days an appeal is filed with the Appeals Board.

Upon receipt by the public body of the notice of the filing of such petition, the public body awarding the contract or authorizing the public work shall extend the closing date for the submission of bids until five days after the final determination of the general prevailing minimum wage rates pursuant to this section and the publication of such findings.

Upon the filing of any such petition, notice thereof and of the extension of the closing date for submission of bids, shall be given forthwith by the awarding public body in a special bulletin to all interested parties as defined herein, notice shall also be given to the bidders by the awarding body of the final determination of the secretary or Appeals Board which shall also be included in the contract. The determination of the secretary or Appeals Board shall be included in the contract.

(8 amended Aug. 9, 1963, P.L. 653, No. 342)

Section 9. Posting of Rates.

Contractors and subcontractors performing public work for a public body subject to the provisions of this act shall post the general prevailing minimum wage rates for each craft and classification involved, as determined by the secretary, including the effective date of any changes thereof, in prominent and easily accessible places at the site of the work, or at such place or places as are used by them to pay workmen their wages.

Section 10. Duty of Public Body.

(a) Before final payment is made by, or on behalf of any public body of any sum or sums due on public work, it shall be the duty of the treasurer of the public body or other officer or person charged with the custody and disbursement of the funds of the public body to require the contractor and subcontractor to file statements, in writing, in form satisfactory to the secretary, certifying to the amounts then due and owing from such contractor and subcontractor, filing such statement to any

and all workmen for wages due on account of public work, setting forth therein the names of the persons whose wages are unpaid and the amount due to each respectively, which statement so to be filed shall be verified by the oath of the contractor and subcontractor, as the case may be, that he has read such statement subscribed by him, knows the contents thereof and that the same is true of his own knowledge: Provided, nevertheless, That nothing herein shall impair the right of a contractor to receive final payment because of the failure of any subcontractor to comply with provisions of this act.

(b) In case any workman shall have filed a protest, in writing, within three months from the date of the occurrence of the incident complained of, with the secretary, objecting to the payment to any contractor to the extent of the amount or amounts due or to become due to the said workman for wages or for labors performed on public works, the secretary shall direct the fiscal or financial officer of the public body, or other person charged with the custody and disbursements of the funds of the public body, to deduct from the whole amount of any payment on account thereof the sum or sums admitted by any contractor in such statement or statements so filed, to be due and owing by him on account of wages earned on such public work before making payment of the amount certified for payment and may withhold the amount so deducted for the benefit of the workmen whose wages are unpaid, as shown by the verified statement filed by any contractor, and may pay directly to any workmen the amount shown to be due to him for such wages by the statements filed as hereinbefore required, thereby discharging the obligation of the contractor to the person receiving such payment to the extent of the amount thereof.

(c) Any contractor or subcontractor who shall, under oath, verify the statement required to be filed under this section, which is known to him to be false, shall be guilty of a misdemeanor, and shall, upon conviction, be sentenced to pay a fine of not exceeding two thousand five hundred dollars (\$2,500) or to undergo imprisonment not exceeding five years, or both.

Section 11. Remedies and Penalties.

(a) The fiscal or financial officer, or any public body having public work performed under which any workman shall have been paid less than the prevailing wage, shall forthwith notify the secretary, in writing, of the name of the person or firm failing to pay the prevailing wages.

(b) Any workman may, within three months from the date of the occurrence of the incident complained of, file a protest, in writing, with the secretary objecting to the amount of wages paid for services performed by him on public work as being less than the prevailing wages for such services.

(c) Whenever a fiscal or financial officer of any public body shall notify the secretary that any person or firm required to pay its workmen the prevailing wage under this act has failed so to do, or whenever any workman employed upon public work shall have filed a timely protest objecting that he has been paid less than prevailing wages as required by this act, it shall be the duty of and the secretary shall forthwith investigate the matter and determine whether or not there has been a failure to pay the prevailing wages and whether such failure was intentional or otherwise. In any such investigation, the secretary shall provide for an appropriate hearing upon due notice to interested parties including the workmen, the employer and their respective representative, if any.

(d) In the event that the secretary shall determine, after notice and hearing as required by this section, that any person or firm has failed to pay the prevailing wages and that such failure was not intentional, he shall afford such person or firm a reasonable opportunity to adjust the matter by making payment or providing adequate security for the payment of the amounts required to be paid under this act as prevailing wages to the workmen affected on such terms and conditions as shall be approved by the secretary.

(e) In the event that the secretary shall determine, after notice and hearing as required by this section, that any person or firm has failed to pay the prevailing wages and that such failure was intentional, he shall thereupon notify all public bodies of the name or names of such persons or firms and no contract shall be awarded to such persons or firms or to any firm, corporation or partnership in which such persons or firms have an interest until three years have elapsed from the date of the notice to the public bodies aforesaid. The secretary may in addition thereto request the Attorney General to proceed to recover the

penalties for the Commonwealth of Pennsylvania which are payable under subsection (f) of this section.

(f) Whenever it shall be determined by the secretary, after notice and hearing as required by this section, that any person or firm has failed to pay the prevailing wages and that such failure was intentional, such persons or firm shall be liable to the Commonwealth of Pennsylvania for liquidated damages, in addition to damages for any other breach of the contract in the amount of the underpayment of wages due any workman engaged in the performance of such contract.

(g) It shall not constitute a failure to pay the prevailing wage rates for the work of a particular craft or classification where the prevailing wage rates determined for a specific craft or classification has been paid, and it is asserted that one or more bona fide craft unions contend that the work should have been assigned to their members instead of the members of the specific craft to whom it was assigned or by whom it was performed.

(h) The following shall constitute substantial evidence of intentional failure to pay prevailing wage rates:

(1) Any acts of omission or commission done wilfully or with a knowing disregard of the rights of workmen resulting in the payment of less than prevailing wage rates.

(2) After there has been a finding by the secretary in the manner required by this section that any person or firm has failed to pay the prevailing wages prescribed by this act and thereafter there shall be a failure by such person or firm to pay the prevailing wages prescribed by this act, or there shall be a subsequent failure of such person or firm to comply with any opportunity to adjust any differences which shall be afforded him by the secretary.

Section 12. Failure to Comply, Termination.

In any case where the secretary shall have determined that any person or firm has failed to pay the prevailing wages under subsections (e) and (f) of section 11 hereof, he may direct the public body to terminate, and the public body may terminate, any such contractor's right to proceed with the public work.

Section 13. Workmen's Rights.

Any workmen paid less than the rates specified in the contract shall have a right of action for the difference between the wage so paid and the wages stipulated in the contract, which right of action shall be instituted within six months from the occurrence of the event creating such right.

Section 14. Rules and Regulations.

The secretary is hereby authorized and empowered to prescribe, adopt, promulgate, rescind and enforce rules and regulations pertaining to the administration and enforcement of the provisions of this act.

Section 15. Application of Act.

This act shall have no application to any public works subject to the Walsh-Healey Act, the act of June 30, 1936, chapter 881, 49 Stat. 2036, 41 USCA sections 35-45, or the Davis Bacon Act, the act of March 3, 1931, 40 U.S. Code 276 (a).

Section 16. Repealer.

All acts and parts of acts are repealed in so far as they are inconsistent herewith.

Section 17. Effective Date.

This act shall take effect on the first day of the sixth month following date of final enactment.

REGULATIONS FOR PENNSYLVANIA PREVAILING WAGE ACT



**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF LABOR AND INDUSTRY
BUREAU OF LABOR LAW COMPLIANCE**

1997 EDITION

R-5

REGULATIONS FOR PREVAILING WAGE ACT - 1

Subchapter E. PREVAILING REGULATIONS

- Sec.
- 9.101. Purpose and scope.
 - 9.102. Definitions.
 - 9.103. Required provisions.
 - 9.104. Duty of the public body.
 - 9.105. Determination of classification and general prevailing minimum wage rates.
 - 9.106. Payment of general prevailing minimum wage rates.
 - 9.107. Petition for review of rates and hearing.
 - 9.108. Posting of wage rates.
 - 9.109. Records and inspection.
 - 9.110. Certification of rate of wage and payment by contractor or subcontractor.
 - 9.111. Remedies and penalties.
 - 9.112. Workmen's rights.

Authority

The provisions of this Subchapter E issued under act of August 15, 1961 (P.L. 987) (43 P.S. § 165-14), unless otherwise noted.

Source

The provisions of this Subchapter E adopted May 23, 1975, 5 Pa.B. 1347, unless otherwise noted.

Notes of Decisions

The Secretary of Labor and Industry's definition of workers as "electricians" on a public works project, and therefore subjecting their employer to payment of the wages not paid in violation of the Pennsylvania Prevailing Wage Act (43 P.S. §§ 165-1 — 165-17) would not be disturbed as the determination was neither erroneous nor inconsistent with the statute. *Henkels & McCoy, Inc. v. Department of Labor and Industry*, 598 A.2d 1065 (Pa. Cmwlth. 1991).

§ 9.101. Purpose and scope.

(a) Every contract to which the Commonwealth, its political subdivisions, an authority created by the General Assembly of the Commonwealth including authorities created under the Municipality Authorities Act of 1945 (53 P. S. §§ 301–401) and instrumentalities or agencies of the Commonwealth is a party, for construction, reconstruction, demolition, alteration or repair work other than maintenance work where the estimated cost of the total project is in excess of \$25,000, which requires or involves the employment by a contractor or subcontractor of laborers, mechanics, skilled and semi-skilled laborers and apprentices in the performance of services directly upon the public work project shall include in its specifications a provision stating the general prevailing minimum wage rates as determined by the Secretary which shall be paid for each craft or classification of workmen needed to perform the contract during the anticipated term thereof in the locality in which the public work is performed.

(b) Every person paid by a contractor or a subcontractor in any manner for his labor in the construction, reconstruction, demolition, alteration or repair work other than maintenance work done under contract and paid for in whole or in part out of the funds of a public body except work performed under a rehabilitation program or manpower training programs is "employed" and "receiving wages."

(c) These regulations do not apply to a public works contracts subject to the Walsh-Healey Act (41 U.S.C.A. §§ 35–45) or section 1 of the Davis-Bacon Act (40 U.S.C.A. § 276(a)).

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(d) Work performed under a rehabilitation program arranged by and at a State institution primarily for teaching and up-grading the skills and employment opportunities of the inmates of the institution is not to be considered public work performed by a public body as defined in the act and this Subchapter.

Notes of Decisions

The court declared the Pennsylvania Prevailing Wage Act (Act) (43 P. S. §§ 165-1–165-17) and its accompanying regulations invalid and unenforceable because they were preempted by ERISA where the Act related to ERISA plans regarding fringe benefits. *Keystone Chapter, Assoc. Builders and Contractors, Ind. v. Foley*, 837 F.Supp. 654 (M. D. PA. 1993).

§ 9.102. Definitions.

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

Act—The Pennsylvania Prevailing Wage Act (43 P. S. §§ 165-1–165-17).

Apprentice—A person employed and working under a bona fide apprenticeship program, directly related to the particular craft involved in the construction industry and registered with an approved by the Pennsylvania Apprenticeship and Training Council and whose training and employment are in full compliance with the provisions of The Apprenticeship and Training Act (43 P. S. §§ 90.1–90.10), approved July 14, 1961.

Authorized deduction—Those deductions which are authorized by the Wage Payment and Collection Law (43 P. S. §§ 260.1–260.45), approved July 14, 1961 and the Regulations of the Department of Labor and Industry issued pursuant thereto.

Bona fide collective bargaining agreement—The agreement negotiated between the historically established and recognized bargaining representatives for the employers and of the workmen for the particular crafts or classifications involved providing for applicable wage rates, hours of work, working conditions and contributions for employe benefits as defined in "contributions for employe benefits" in this section.

Classification—Specific categories of jobs which are performed within a "craft" as defined in this section. The term includes those specific categories of jobs which are performed by a "workman," as defined in section 2(7) of the act (43 P. S. § 165-2(17)) and this section, and "apprentice," as defined in this section.

Contributions for employe benefits—"Fringe benefits" paid or to be paid, including payment made whether directly or indirectly, to the workmen for sick, disability, death, other than Workmen's Compensation, medical, surgical, hospital, vacation, travel expense, retirement and pension benefits.

Craft—Special skills and trades which are recognized as such by custom and usage in the building and construction industry.

Department—The Department of Labor and Industry of the Commonwealth.

General prevailing minimum wage rates, prevailing wage rates, minimum wage rates and wage rates—Rates as determined by the Secretary, as payable in the locality in which the public work is to be performed, for the respective crafts and classifications, including the amount of contributions for employe benefits as required by the act.

Locality—A political subdivision, or combination of the same, within the county in which the public work is to be performed. When no workmen for which a prevailing minimum wage is to be determined hereunder are employed in the locality, the locality may be extended to include adjoining

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political subdivisions where the workmen are employed in those crafts or trades for which there are no workmen employed in the locality as otherwise herein defined.

Maintenance work—The repair of existing facilities when the size, type or extent of the facilities is not thereby changed or increased.

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

Public work—Construction, reconstruction, demolition, alteration or repair work other than maintenance work, done under contract and paid for in whole or in part out of the funds of a public body where the estimated cost of the total project is in excess of \$25,000. The term does not include work performed under a rehabilitation or manpower training program.

Secretary—The Secretary of Labor and Industry or his authorized deputy or representative.

Workman—Includes laborer, mechanic, skilled and semiskilled laborer and apprentices employed by a contractor or subcontractor and engaged in the performance of services directly upon the public work project, regardless of whether their work becomes a component part thereof. The term does not include material suppliers or their employes who do not perform services at the job site.

Notes of Decisions

Preemption

The union fund correctly argued that its suit under the Public Works Contractors' Bond Law (8 P. S. § 191 et seq.) was not preempted by Employee Retirement and Income Security Act (ERISA), 29 U.S.C.A. § 1001 et seq., because the Bond Law made no reference to ERISA plans and was not related to employee benefit plans or the enforcement of those plans. Thus, the Union Fund's cause of action against the bond insuring company can survive the company's motion for summary judgment. *Carpenters v. National Union Fire Insurance of Pittsburgh*, 686 A.2d 1373 (Pa. Cmwlth. 1996).

Cross References

This section cited in 34 Pa. Code § 9.105 (relating to determination of classification and general prevailing minimum wage rates).

§ 9.103. Required provisions.

The specifications for every contract for a public work as defined herein shall contain at least the following conditions, provisions and requirements:

- (1) The general prevailing minimum wage rates including contributions for employee benefits as determined by the Secretary which shall be paid to the workmen employed in the performance of the contract. The contract shall specifically provide that the contractor shall pay at least the wage rates as determined in the decision of the Secretary of Labor and Industry and shall comply with the conditions of the act approved August 15, 1961, and the regulations issued thereto, to assure the full and proper payment of the rates.
- (2) The contract shall contain the stipulation that workmen shall be paid at least the general prevailing minimum wage rates and other provisions to assure payment thereof as set forth in this section.
- (3) The contract provisions apply to work performed on the contract by the contractor and to work performed on the contract by subcontractors.

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(4) The contractor shall insert in each of his subcontracts the stipulations contained in these required provisions and other stipulations as may be required.

(5) The contract shall provide that no workmen may be employed on the public work except in accordance with the classifications in the decision of the Secretary. If additional or different classifications are necessary the procedure in § 9.107 (relating to petition for review of rates and hearings) shall be followed.

(6) The contract shall provide that workmen employed or working on the public work shall be paid unconditionally, regardless of whether a contractual relationship exists or the nature of a contractual relationship which may be alleged to exist between a contractor, subcontractor and workmen, at least once a week, without deduction or rebate, on any account, either directly or indirectly except authorized deductions, the full amounts due at the time of payment, computed at the rates applicable to the time worked in the appropriate classification. Nothing in the contract, the act or this title prohibits the payment of more than the general prevailing minimum wage rates as determined by the Secretary to a workman on public work.

(7) The contract shall provide that the contractor and each subcontractor shall post for the entire period of construction the wage determination decisions of the Secretary, including the effective date of changes thereof, in a prominent and easily accessible place or places at the site of the work and at the places used by them to pay workmen their wages. The posted notice of wage rates shall contain the following information:

(i) The name of project.

(ii) The name of the public body for which it is being constructed.

(iii) The crafts and classifications of workmen listed in the Secretary's general prevailing minimum wage rate determination for the particular project.

(iv) The general prevailing minimum wage rates determined for each craft and classification and the effective date of changes.

(v) A statement advising workmen that if they have been paid less than the general prevailing minimum wage rate for their job classification or that the contractor or subcontractor are not complying with the act or this title, they may file a protest in writing with the Secretary within 3 months of the date of the occurrence, objecting to the payment to a contractor to the extent of the amount due or to become due to them as wages for work performed on the public work project. A workmen paid less than the rate specified in the contract shall have a civil right of action for the difference between the wage paid and the wages stipulated in the contract, which right of action shall be exercised within 6 months from the occurrence of the event creating the right.

(8) The contract shall provide that the contractor and subcontractors shall keep an accurate record showing the name, craft or classification, number of hours worked per day and the actual hourly rate of wage paid, including employee benefits, to each workman employed by him in connection with the public work. The record shall include deductions from each workman. The record shall be preserved for 2 years from the date of payment and shall be open at reasonable hours to the inspection of the public body awarding the contract and to the Secretary or his authorized representatives.

(9) The contract shall provide that apprentices shall be limited to numbers in accordance with a bona fide apprenticeship program registered with and approved by The Pennsylvania Apprenticeship and Training Council and only apprentices whose training and employment are in full compliance with The Apprenticeship and Training Act (43 P. S. §§ 90.1–90.10), approved July 14, 1961, and the regulations issued thereto shall be employed on the public work project. A workman using the tools of a craft who does not qualify as an apprentice within this subsection shall be paid the rate predetermined for journeymen in that particular craft or classification.

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(10) Wages shall be paid without deductions except authorized deductions. Employers not parties to a contract requiring contributions for employee benefits which the Secretary has determined to be included in the general prevailing minimum wage rate shall pay the monetary equivalent thereof directly to the workmen.

(11) Payment of compensation to workmen for work performed on public work on a lump sum basis, or a piece work system, or a price certain for the completion of a certain amount of work, or the production of a certain result shall be deemed a violation of the act and this subchapter, regardless of the average hourly earnings resulting therefrom.

(12) The contract shall also provide that 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 workmen have been paid wages in strict conformity with the provisions of the contract as prescribed by this section or if wages remain unpaid to set forth the amount of wages due and owing to each workman respectively.

(13) The provisions of the act and this subchapter shall be incorporated by reference in the contract.

Cross References

This section cited in 34 Pa. Code § 9.108 (relating to posting of wage rates); and 34 Pa. Code § 9.110 (relating to certification of rate of wage and payment by contractor or subcontractor).

§ 9.104. Duty of the public body.

(a) It is the duty of the public body awarding a contract for public work to request the Secretary for determination of the general prevailing minimum wage rates to be paid workmen on the public work project. The request shall be made on forms issued for the purpose by the Department. A new request for predetermination shall be made if the contract is not awarded within 120 days from the determination date.

(b) It is the duty of the public body to enforce the posting of wage rate determinations in accordance with the provisions of section 9 of the act (43 P. S. § 165-9) and § 9.108 (relating to posting of wage rates). The fiscal officer of the public body, the treasurer or other officer of the public body, charged with the custody and disbursement of the funds of the public body, shall ascertain that the wage rates as determined by the Secretary are paid and that the job classifications are maintained, otherwise it is his duty to hold up final payment and to inform the Secretary of the failure by the contractor or a subcontractor to comply with the act.

Notes of Decisions

Time Limitations

Although the borough awarded the company the contract more than 120 days after the determination of the prevailing minimum wage and although the borough never made a new request for a predetermination, the company waived its right to protest the predetermination by failing to adhere to the 120 day time period. *Linde Enter., Inc. v. Prevailing Wage Appeals Board*, 676 A.2d 310 (Pa. Cmwlth. 1996).

§ 9.105. Determination of classification and general prevailing minimum wage rates.

(a) For the purpose of making a determination of the general prevailing minimum wage rates in the locality in which the public work is to be performed for each craft or classification during the anticipated term of the contract, the Secretary may ascertain and consider the wage rates and employee benefits established by collective bargaining agreements.

(b) If a bona fide collective bargaining agreement has expired by the terms thereof, the Secretary

may ascertain and consider the wage rates and employe benefits established thereby until a new bona fide collective bargaining agreement, as defined in § 9.102 (relating to definitions), has been executed.

(c) The Secretary may also consider the following:

(1) Information obtained from Federal agencies charged with the administration of labor standards provisions of Federal acts applicable to contracts covering contractors and subcontractors on public building and public work and on building and work financed in whole or in part by loans and grants of the United States, within the locality.

(2) The number of skilled, competent and experienced workmen within the locality who are generally available for employment on public work.

(3) Statements signed and certified by contractors and subcontractors and union representatives showing wage rates paid on projects, within the locality. These statements to be relevant to a wage determination shall indicate the names and addresses of the contractors, including the subcontractors, the locations, approximate cost, dates of construction and type of projects, the number of workmen employed and the number of man hours worked in each craft or classification on each project and the respective wage rates paid the workmen, which wage rates shall consist only of rates paid for services performed solely within the classification for which it is submitted.

(4) Other information pertinent to the determination of prevailing minimum wage rates.

(d) The Secretary will conduct a continuing program for obtaining and compiling of wage rate information and shall encourage the voluntary submission of wage rate data by contractors, contractors' associations, labor organizations, public officials and other interested parties, reflecting wage rates paid to workmen in the various types of construction in the locality. Rates shall be determined for varying types of projects within the entire range of work performed by the building and construction industry. Information submitted shall reflect not only the specified wage rate or rates paid to a particular craft in the locality but also the type or types of construction on which the wage rate or rates have been paid. If the Secretary deems that the data at hand is insufficient to make a determination with respect to the crafts or classifications necessary to perform the proposed public work, he may have a field survey conducted by his staff representative for the purpose of obtaining additional information upon which to make a determination of the wage rates, and also the customs, usages and practices as to the type of work to which the wage rates apply and the size of available force of qualified workmen within the locality in which the public work is to be performed.

Notes of Decisions

Granting authority to the Secretary to consider fringe benefits determined by collective bargaining when he is making prevailing wage determinations is not an unconstitutional denial of equal protection to nonunion contractors and employes, since he is not required to make his determination solely on the basis of rates in collective bargaining. *Keystone Chapter of Associated Builders and Contractors, Inc. v. Department of Labor and Industry*, 414 A.2d 1129 (Pa. Cmwlth. 1980).

If the parties introduce exhibits which in some way do not comply with the standards of 34 Pa. Code § 9.105(c)(3), the Secretary may give more weight to evidence which includes fringe benefits and projects of every nature and which clearly demonstrates prevailing wage rates for the year in question rather to evidence which does not include fringe benefits, excludes public works projects and some major private projects, and lumps together wage rates from previous years to establish current wage rates. *Keystone Chapter of Associated Builders and Contractors, Inc. v. Department of Labor and Industry*, 414 A.2d 1129 (Pa. Cmwlth. 1980).

§ 9.106. Payment of general prevailing minimum wage rates.

(a) Not less than the general prevailing minimum wage rates determined by the Secretary under the

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act and this subchapter may be paid unconditionally, by contractors and subcontractors to workmen in their respective crafts and classifications on public work and the workmen can not be required to refund, directly or indirectly, part of the wages. It is no defense that workmen accepted or agreed to accept less than the required rate of wages or voluntarily made refunds, in any form or manner.

(b) Wages shall be paid without deductions except authorized deductions. Employers not parties to a contract requiring contributions for employee benefits which the Secretary has determined to be included in the general prevailing minimum wage rate shall pay the monetary equivalent thereof directly to the workmen.

(c) Payment of compensation to workmen for work performed on public work on a lump sum basis or a piece work system or a price certain for the completion of certain amount of work or the production of a certain result shall be deemed a violation of the act and this subchapter, regardless of the average hourly earnings resulting therefrom.

§ 9.107. Petition for review of rates and hearings.

(a) A prospective bidder or his representative, a representative of a group of employers engaged in the particular type of construction, reconstruction, demolition, alteration or repair work, a representative of a craft or classification of workmen or the public body affected by the determination made by the Secretary, may on verified petition request a review of this determination in accordance with the procedures required by section 8 of the act (43 P. S. § 165-8).

(b) The Secretary will, after notice and hearing as prescribed by section 8 of the act, make a final determination of the general prevailing minimum wage rates to be paid to workmen on the public work project. The public body when notified by the Secretary that a verified petition has been filed shall extend the closing date for the submission of bids until 5 days after the Secretary's final determination. Within 10 days after hearing the Secretary will make a determination and transmit it in writing to the public body and to the interested parties. This determination shall be final unless within 10 days an appeal is filed with the Appeals Board.

(c) If, after a contract has been awarded, it is deemed advisable by the public body because of unforeseen construction development to list an additional classification and wage rate therefor the public body shall request, in writing, a determination thereof by the Secretary. A copy of this request shall be given to interested parties and shall also be posted at an appropriate place at the site of the public work project. The Secretary will thereupon give consideration to the request and if he determines that the additional classification requested is necessary, he will determine the classification and wage rate therefor and notify the interested parties of his determination, which shall be effective as of the date on which it is made. Additional classifications shall be made in conformity with this procedure.

Cross References

This section cited in 34 Pa. Code § 9.103 (relating to required provisions).

§ 9.108. Posting of wage rates.

The contractors and subcontractors on the public work project shall post a notice or notices in the manner and form prescribed by § 9.103 (relating to required provisions). This notice is to be clearly legible and placed in a prominent and easily accessible place at the site of the public work project and at places used by them to pay workmen their wages.

Cross References

This section cited in 34 Pa. Code § 9.104 (relating to duty of the public body).

§ 9.109. Records and inspection.

The accurate record of employment and wage payments required to be kept and preserved by contrac-

tors and subcontractors on public work shall include at least the following information:

(1) The name, address and social security number of each workman.

(2) The craft, if applicable, the classification within each craft, and any other classification including apprenticeship, at which the workman worked. These records shall show the number of hours in each day, specified by actual calendar date, during which each workman worked and if he worked in more than one craft or classification for which different rates were payable the records shall show the number of hours in each day as aforesaid in which he worked at the different crafts or classifications. Time cards of employes shall be kept and preserved as records required by the act and this subchapter. In addition, the original signed indentures for each apprentice and the approvals of the Pennsylvania Apprenticeship and Training Council shall be kept. The records shall be preserved for 2 years from date of payment and shall be open at all reasonable hours for inspection by the public body awarding the contract and by the Secretary, and shall be made easily accessible within this Commonwealth within a period of 7 days from the date on which the Secretary requests in writing that these records be made so available.

§ 9.110. Certification of rate of wage and payment by contractor or subcontractor.

(a) It is the duty of the treasurer or other officer charged with the custody and disbursement of public funds applicable to the public work contract under and pursuant to which payment is made, to require the contractor and subcontractor to file a statement each week and a final statement at the conclusion of the work on the contract with the contracting agency under oath in form satisfactory to the Secretary certifying that workmen have been paid wages in strict conformity with the contract as prescribed by § 9.103(7) (relating to required provisions) or if wages remain unpaid to set forth the amount of wages due and owing to each workman respectively.

(b) It is the duty of the treasurer or other officer charged with the custody and disbursement of public funds to withhold the amount of wages unpaid or not paid in accordance with § 9.103 for the benefit of the workman whose wages have not been paid by the contractor and he may pay directly to a workman the amount shown to be due him. Each contractor and subcontractor shall also certify that he is not receiving or requiring, or will not receive or require, directly or indirectly, from a workman a refund of the minimum wage.

(c) A contractor or subcontractor who shall, under oath, verify the statements required to be filed under section 10 of the act (43 P. S. § 165-10) which are known to him to be false, shall be guilty of a misdemeanor, and shall, upon conviction, be sentenced to pay a fine of not exceeding \$2,500 or to undergo imprisonment not exceeding 5 years, or both.

§ 9.111. Remedies and penalties.

(a) It is the duty of the Secretary where a timely protest has been filed by a workman that he has been paid less than the general prevailing minimum wage rate, to investigate the matter and determine whether or not there has been a failure to pay the general prevailing minimum wage rate and whether this failure was intentional or otherwise. The Secretary will hold appropriate hearings upon due notice to interested parties including the workman, the employer and their respective representatives, if any. If the Secretary, after hearing, has determined that the failure to pay the general prevailing minimum wage rate was not intentional he shall afford the person or firm a reasonable opportunity to adjust the matter by making payment to the workmen or providing adequate security to insure payment. If the Secretary determines that the failure to pay the general prevailing minimum wage rates intentional, he will thereupon notify the public bodies of the names of the persons or firms and no contract may be awarded to the person or firms or to a firm, corporation or partnership in which the person or firms have an interest until 3 years have elapsed from the date of the notice to the public bodies. The Secretary may, in addition thereto, request the Attorney General to proceed to recover the penalties for the Commonwealth of Pennsylvania which are payable under section 11(f) of the act (43 P. S. 16511(f)).

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(b) The following constitutes substantial evidence of intentional failure to pay prevailing wage rates:

(1) Acts of omission or commission done willfully or with a knowing disregard of the rights of workmen resulting in the payment of less than prevailing wage rates.

(2) If the Secretary has made a finding that a person or firm has failed to pay the general prevailing minimum wage rate as determined by the Secretary in accordance with the act, and thereafter a person or firm continues to fail to pay the prevailing wages or a person or firm fails to comply with an opportunity to adjust differences which shall be afforded him by the Secretary.

(c) If the Secretary has determined that a person or firm has failed to pay the prevailing wages under section 11(e) and (f) of the act (43 P. S. § 165(e) and 165(f)), he may direct the public body to terminate, and the public body may terminate, the contractor's right to proceed with the public work.

Notes of Decisions

Statute of Limitations

There is no language in this regulation which provides for a statute of limitations applicable to the Department of Labor and Industry's initiation of enforcement actions for underpayment of workers. *Linde Enter., Inc. v. Prevailing Wage Appeals Board*, 676 A.2d 310 (Pa. Cmwlth. 1996).

§ 9.112. Workmen's rights.

(a) A workman who has been paid less than the general prevailing minimum wage rate for his job classification as specified in the contract or who has not been paid, may file a protest, in writing with the Secretary within 3 months of the date of the occurrence, objecting to the payment to a contractor to the extent of the amount due or to become due to him as wages for work performed on the public work project. If the formal protest is filed with the Secretary, it is the duty of the Secretary to direct the fiscal or financial officer of the public body or the person charged with the custody of the disbursement of the funds of the public body, to deduct the money so due and owing from the whole amount or of any payment due the contractor.

(b) Any workmen paid less than the rates specified in the contract shall have a right of action for the difference between the wage paid and the wages stipulated in the contract, which right of action must be exercised within 6 months from the occurrence of the event creating the right.

Notes of Decisions

Statute of Limitations

There is no language in this regulation which provides for a statute of limitations applicable to the Department of Labor and Industry's initiation of enforcement actions for underpayment of workers. *Linde Enter., Inc. v. Prevailing Wage Appeals Board*, 676 A.2d 310 (Pa. Cmwlth. 1996).

**PART I
PENNSYLVANIA STATUTES**

I. Purdon’s Statutes – Title 3 (Agriculture)

Fertilizer Act, 3 Pa. C.S.A. §6701.

Soil and Plant Amendment Act, 3 Pa. C.S.A. §6901.

PA Pesticide Control Act of 1973, Act of March 1, 1974 (P.L. 90, No. 24), as amended, 3 P.S. 111.21 et seq.

Agricultural Liming Materials Act, Act of March 17, 1978 (P.L. 15, No. 9), as amended, 3 P.S. 132-1 et seq.

Noxious Weed Control Law, Act of April 7, 1982 (P.L. 228, No. 74), as amended, 3 P.S. 255.1 et seq.

Plant Pest Act, Act of December 16, 1992 (P.L. 1228, No. 162), as amended, 3 P.S. 258.1 et seq.

Conservation District Law, Act of May 15, 1945 (P.L. 547), as amended, 3 P.S. 849 et seq.

(Relating to Weather Modification), Act of January 19, 1968 (P.L. (1967) 1024), as amended, 3 P.S. 1101 et seq.

II. Purdon’s Statutes – Title 16 (Counties)

(Relating to Land Use), Act of January 13, 1966 (P.L. (1965) 1292), as amended, 16 P.S. 11941 et seq.

III. Purdon’s Statutes – Title 18 (Crimes and Offenses)

The Crimes Code, Act of December 6, 1972 (P.L. 1482, No. 332), as amended, 18 Pa. C. S. A. 101 et seq.

IV. Purdon’s Statutes – Title 24 (Education)

Public School Code of 1949, Act of March 10, 1949 (P.L. 30), as amended, 24 P.S. 1-101 et seq.

V. Purdon’s Statutes – Title 30 (Fish)

The Fish and Boat Code, Act of October 16, 1980 (P.L. 996, No. 175), as amended, 30 Pa. C. S. A. 101 et seq.

VI. Purdon’s Statutes – Title 32 (Forests, Waters and State Parks)

(Relating to Water Power and Water Supply Permits), Act of June 14, 1923 (P.L. 704), as amended, 32 P.S. 591 et seq.

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Water Well Drillers License Act, Act of May 29, 1956 (P.L. (1955) 1840), as amended, 32 P.S. 645.1 et seq.

(Relating to Flood Control), Act of August 7, 1936 (P.L. 106, 1st Ex. Sess., No. 46), as amended, 32 P.S. 653 et seq.

Flood Plain Management Act, Act of October 4, 1978 (P.L. 851, No. 166), as amended, 32 P.S. 679.101 et seq.

Storm Water Management Act, Act of October 4, 1978 (P.L. 864, No. 167), as amended, 32 P.S. 680.1 et seq.

Dam Safety and Encroachments Act, Act of November 26, 1978 (P.L. 1375, No. 325), as amended, 32 P.S. 693.1 et seq.

(Relating to Stream Clearance), Act of June 5, 1947 (P.L. 422), as amended, 32 P.S. 701 et seq.

(Relating to Potomac River Pollution), Act of May 29, 1945 (P.L. 1134), as amended, 32 P.S. 741 et seq.

(Relating to Schuylkill River Pollution), Act of June 4, 1945 (P.L. 1383), as amended, 32 P.S. 751.1 et seq.

(Relating to Delaware River Pollution), Act of April 19, 1945 (P.L. 272), as amended, 32 P.S. 815.31 et seq.

Delaware River Basin Compact, Act of July 7, 1961 (P.L. 518), as amended, 32 P.S. 815.101 et seq.

Ohio River Valley Water Sanitation Compact, Act of April 2, 1945 (P.L. 103), as amended, 32 P.S. 816.1 et seq.

Great Lakes Protection Fund Act, Act of July 6, 1989 (P.L. 215, No. 34), as amended, 32 P.S. 817.11 et seq.

Brandywine River Valley Compact, Act of September 9, 1959 (P.L. 848), as amended, 32 P.S. 818 et seq.

Wheeling Creek Watershed Protection and Flood Prevention District Compact, Act of August 2, 1967 (P.L. 189), as amended, 32 P.S. 819.1 et seq.

Susquehanna River Basin Compact, Act of July 17, 1968 (P.L. 368, No. 181), as amended, 32 P.S. 820.1 et seq.

Chesapeake Bay Commission Agreement, Act of June 25, 1985 (P.L. 64, No. 25), as amended, 32 P.S. 820.11 et seq.

(Relating to Preservation and Acquisition of Land for Open Space Uses), Act of January 19, 1968 (P.L. (1967) 992), as amended, 32 P.S. 5001 et seq.

Land and Water Conservation and Reclamation Act, Act of January 19, 1968 (P.L. (1967) 996), as amended, 32 P.S. 5101 et seq.

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Bluff Recession and Setback Act, Act of May 13, 1980 (P.L. 122, No. 48), as amended, 32 P.S. 5201 et seq.

Wild Resource Conservation Act, Act of June 23, 1982 (P.L. 597, No. 170), as amended, 32 P.S. 5301 et seq.

Cave Protection Act, Act of November 21, 1990 (P.L. 539, No. 133), as amended, 32 P.S. 5601 et seq.

Rails to Trails Act, Act of December 18, 1990 (P.L. 748, No. 188), as amended, 32 P.S. 5611 et seq.

VII. Purdon's Statutes – Title 34 (Game)

The Game and Wildlife Code, Act of July 8, 1986 (P.L. 442, No. 93), as amended, 34 Pa. C.S.A. 101 et seq.

VIII. Purdon's Statutes – Title 35 (Health and Safety)

(Related to Public Eating and Drinking Places), Act of May 23, 1945 (P.L. 926), as amended, 35 P.S. 655.1 et seq.

The Public Bathing Law, Act of June 23, 1931 (P.L. 899), as amended, 35 P.S. 672 et seq.

The Clean Streams Law, Act of June 22, 1937 (P.L. 1987), as amended, 35 P.S. 691.1 et seq.

Environmental Stewardship and Watershed Protection Act, 27 Pa. C.S.A. §6101, et. seq.

PA Safe Drinking Water Act, Act of May 1, 1984 (P.L. 206, No. 43), as amended, 35 P.S. 721.1 et seq.

Phosphate Detergent Act, Act of July 5, 1989 (P.L. 166, No. 31), as amended, 35 P.S. 722.1 et seq.

Plumbing System Lead Ban and Notification Act, Act of July 6, 1989 (P.L. 207, NO. 33), as amended, 35 P.S. 723.1 et seq.

PA Sewage Facilities Act, Act of January 24, 1966 (P.L. (1965) 1535), as amended, 35 P.S. 750.1 et seq.

Publicly Owned Treatment Works Penalty Law, Act of March 26, 1992 (P.L. 23, No. 9), as amended, 35 P.S. 752.1 et seq.

PA Solid Waste-Resource Recovery Development Act, Act of July 20, 1974 (P.L. 572, No. 198), as amended, 35 P.S. 755.1 et seq.

(Related to Pollution from Abandoned Mines), Act of December 15, 1965 (P.L. 1075), as amended, 35 P.S. 760.1 et seq.

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Sewage System Cleaner Control Act, Act of May 28, 1992 (P.L. 249, No. 41), as amended, 35 P.S. 770.1 et seq.

(Related to Camp Regulation), Act of November 10, 1959 (P.L. 1400), as amended, 35 P.S. 3001 et seq.

Air Pollution Control Act, Act of January 8, 1960 (P.L. (1959) 2119), as amended, 35 P.S. 4001 et seq.

(Related to Noise Pollution), Act of June 2, 1988 (P.L. 452, No. 74), as amended, 35 P.S. 4501 et seq.

Solid Waste Management Act, Act of July 7, 1980 (P.L. 380, No. 97), as amended, 35 P.S. 6018.101 et seq.

(Related to Infectious and Chemotherapeutic Waste Disposal), Act of July 13, 1988 (P.L. 525, No. 93), as amended, 35 P.S. 6019.1 et seq.

Hazardous Sites Cleanup Act, Act of October 18, 1988 (P.L. 756, No. 108), as amended, 35 P.S. 6020.101 et seq.

Storage Tank and Spill Prevention Act, Act of July 6, 1989 (P.L. 169, No. 32), as amended, 35 P.S. 6021.101 et seq.

Hazardous Material Emergency Planning and Response Act, Act of December 7, 1990 (P.L. 639, No. 1650, as amended, 35 P.S. 6022.101 et seq.

Oil Spill Responder Liability Act, Act of June 11, 1992 (P.L. 303, No. 52), as amended, 35 P.S. 6023.1 et seq.

Land Recycling and Environmental Remediation Standards Act, Act of May 19, 1995 (P.L. 4, No. 2), as amended, 35 P.S. 6026.101 et seq.

Radiation Protection Act, Act of July 10, 1984 (P.L. 688, No. 147), as amended, 35 P.S. 7110.101 et seq.

Low-Level Radioactive Waste Disposal Act, Act of February 9, 1988 (P.L. 31, No. 12), as amended, 35 P.S. 7130.101 et seq.

Worker and Community Right-to-Know Act, Act of October 5, 1984 (P.L. 734, No. 159), as amended, 35 P.S. 7301 et seq.

IX. Purdon's Statutes – Title 36 (Highways and Bridges)

State Highway Law, Act of June 1, 1945 (P.L. 1242), as amended, 36 P.S. 670-101 et seq.

(Related to Junkyards Along Highways), Act of July 28, 1966 (P.L. 91, Sp. Sess.), as amended, 36 P.S. 2719.1 et seq.

Highway Vegetation Control Act, Act of December 20, 1983 (P.L. 293, No. 79), as amended, 36 P.S. 2720.1 et seq.

PART I – PENNSYLVANIA STATUTES - 4

X. Purdon’s Statutes – Title 37 (Historical and Museums)

History Code, Act of May 26, 1988 (P.L. 414, No. 72), as amended, 37 Pa. C.S.A. 101 et seq.

XI. Purdon’s Statutes – Title 43 (Labor)

(Related to General Safety), Act of May 18, 1937 (P.L. 654), as amended, 43 P.S. 25-1 et seq.

Seasonal Farm Labor Act, Act of June 23, 1978 (P.L. 537, No. 93), as amended, 43 P.S. 1301.101 et seq.

XII. Purdon’s Statutes – Title 52 (Mines and Mining)

The Coal Mine Sealing Act of 1947, Act of June 30, 1947 (P.L. 1177), as amended, 52 P.S. 28.1 et seq.

Coal Refuse Disposal Control Act, Act of September 24, 1968 (P.L. 1040, No. 318), as amended, 52 P.S. 30.51 et seq.

(Related to Coal Land Improvement), Act of July 19, 1965 (P.L. 216, No. 117), as amended, 52 P.S. 30.101 et seq.

(Related to Mine Fires and Subsidence), Act of April 3, 1968 (P.L. 92, No. 42), as amended, 52 P.S. 30.201 et seq.

PA Anthracite Coal Mine Act, Act of November 10, 1965 (P.L. 721, No. 346), as amended, 52 P.S. 70-101 et seq.

(Related to Discharge of Coal into Banks of Streams), Act of June 27, 1913 (P.L. 640), as amended, 52 P.S. 631 et seq.

(Related to Caving-in, Collapse, Subsidence), Act of May 27, 1921 (P.L. 1198), as amended, 52 P.S. 661 et seq.

(Related to Subsidence), Act of September 20, 1961 (P.L. 1538), as amended, 52 P.S. 672.1 et seq.

Anthracite Strip Mining and Conservation Act, Act of June 27, 1947 (P.L. 1095), as amended, 52 P.S. 681.1 et seq.

(Related to Control and Drainage of Water from Coal Formations), Act of July 7, 1955 (P.L. 258), as amended, 52 P.S. 682 et seq.

(Related to Maps and Plans), Act of June 15, 1911 (P.L. 954), as amended, 52 P.S. 823.

Surface Mining Conservation and Reclamation Act, Act of May 31, 1945 (P.L. 1198), as amended, 52 P.S. 1396.1 et seq.

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The Bituminous Mine Subsidence and Land Conservation Act, Act of April 27, 1966 (P.L. 31, 1st Sp. Sess.), as amended, 52 P.S. 1406.1 et seq.

(Related to Cave-in or Subsidence of Surface Above Mines), Act of July 2, 1937 (P.L. 2787), as amended, 52 P.S. 1407 et seq.

(Related to Coal Stripping), Act of June 18, 1941 (P.L. 133), as amended, 52 P.S. 1471 et seq.

(Related to Coal under State Lands), Act of June 1, 1933 (P.L. 1409), as amended, 52 P.S. 1501 et seq.

(Related to Mining Safety Zones), Act of December 22, 1959 (P.L. 1994), as amended, 52 P.S. 3101 et seq.

(Related to Coal Mine Subsidence Insurance Fund), Act of August 23, 1961 (P.L. 1068), as amended, 52 P.S. 3201 et seq.

Interstate Mining Compact, Act of May 5, 1966 P.L. 40, Sp. Sess. No. 1), as amended, 52 P.S. 3251 et seq.

Noncoal Surface Mining Conservation and Reclamation Act, Act of December 19, 1984 (P.L. 1093, No. 219), as amended, 52 P.S. 3301 et seq.

XIII. Purdon's Statutes – Title 53 (Municipal Corporation)

Municipal Waste Planning, Recycling and Waste Reduction Act, Act of July 28, 1988 (P.L. 556, No. 101), as amended, 53 P.S. 4000.101 et seq.

XIV. Purdon's Statutes – Title 58 (Oil and Gas)

Oil and Gas Conservation Law, Act of July 25, 1961 (P.L. 825), as amended, 58 P.S. 401 et seq.

PA Used Oil Recycling Act, Act of April 9, 1982 (P.L. 314, No. 89), as amended, 58 P.S. 471 et seq.

Coal and Gas Resource Coordination Act, Act of December 18, 1984 (P.L. 1069), No. 214), as amended, 58 P.S. 501 et seq.

Oil and Gas Act, Act of December 19, 1984 (P.L. 1140, No. 223), as amended, 58 P.S. 601.101 et seq.

XV. Purdon's Statutes – Title 63 (Professions and Occupations)

Water and Wastewater Systems Operators' Certification Act, Act of November 18, 1968 (P.L. 1052, No. 322), as amended, 63 P.S. 1001 et seq.

XVI. Purdon's Statutes – Title 64 (Public Lands)

PA Appalachian Trail Act, Act of April 28, 1978 (P.L. 87, No. 41), as amended, 64 P.S. 801 et seq.

PART I – PENNSYLVANIA STATUTES - 6

XVII. Purdon's Statutes – Title 71 (State Government)

The Administrative Code of 1929, Act of April 9, 1929 (P.L. 177, No. 175), as amended, 71 P.S. 51 et seq.

Conservation and Natural Resources Act, Act of June 28, 1995 (P.L. 89, No. 18), as amended, 71 P.S. 1340.101 et seq.

XVIII. Purdon's Statutes – Title 72 (Taxation and Fiscal Affairs)

Project 70 Land Acquisition and Borrowing Act, Act of June 22, 1964 (P.L. 131), Sp. Sess., No. 8), as amended, 72 P.S. 3946.1 et seq.

(Related to Pollution Control Devices), Act of March 4, 1971 (P.L. 6, No. 2), as amended, 72 P.S. 7602.1 et seq.

XIX. Purdon's Statutes – Title 73 (Trade and Commerce)

(Related to Explosives), Act of July 1, 1937 (P.L. 2681), as amended, 73 P.S. 151 et seq.

(Related to Explosives), Act of July 10, 1957 (P.L. 685), as amended, 73 P.S. 164 et seq.

(Related to Black Powder), Act of May 31, 1974 (P.L. 304, No. 96), as amended, 73 P.S. 169 et seq.

(Related to Excavation and Demolition), Act of December 10, 1974 (P.L. 852, No. 287), as amended, 73 P.S. 176 et seq.

Infrastructure Development Act, 73 P.S. §393.21, et seq.

XX. Purdon's Statutes – Title 75 (Vehicles)

Vehicle Code, Act of June 17, 1976 (P.L. 162, No. 81), as amended, 75 Pa. C.S.A. 101 et seq.

Snowmobile and All-Terrain Vehicle Law, Act of June 17, 1976 (P.L. 162, No. 81), as amended, 75 Pa. C.S.A. 7701 et seq.

(Related to Hazardous Materials Transport), Act of June 30, 1984 (P.L. 473, No. 99), as amended, 75 Pa. C.S.A. 8301 et seq.

XXI. Purdon's Statutes – Title 77 (Workmen's Compensation)

PA Workers' Compensation Act, Act of June 2, 1915 (P.L. 736), as amended, 77 P.S. 1 et seq.

PA Occupational Disease Act, Act of June 21, 1939 (P.L. 566, No. 284), as amended, 77 P.S. 1201 et seq.

XXII. Pennsylvania Constitution – Article 1, Section 27 (Adopted May 18, 1971).

PART I – PENNSYLVANIA STATUTES - 7

**PART II
FEDERAL STATUTES**

Acid Precipitation Act of 1980 (42 U.S.C. 8901-8912)

Act to Prevent Pollution from Ships (33 U.S.C. 1901-1912)

Asbestos Hazard Emergency Response Act of 1986 (see Toxic Substances Control Act Sections 201-214 (15 U.S.C. 2651-2654))

Atomic Energy Act of 1954 (42 U.S.C. 2014, 2021, 2021a, 2022, 2111, 2113, 2114)

Clean Air Act (42 U.S.C. 7401-7642)

Clean Water Act (see Federal Water Pollution Control Act)

Coastal Wetlands Planning, Protection and Restoration Act (16 U.S.C. 3951-3956)

Coastal Zone Management Act of 1972 (16 U.S.C. 1451-1464)

Community Environmental Response Facilitation Act (42 U.S.C. 9620 note)

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601-9675)

Emergency Planning and Community Right-To-Know Act of 1986 (42 U.S.C. §§11001-11050)

Endangered Species Act of 1973 (16 U.S.C. 1531-1544)

Energy Supply and Environmental Coordination Act of 1974 (15 U.S.C. 791-798)

Environmental Quality Improvement Act of 1970 (42 U.S.C. 4371-4375)

Federal Facility Compliance Act of 1992 (42 U.S.C. 6901 note)

Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136-136y)

Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701-1784)

Federal Water Pollution Control Act (33 U.S.C. 1251-1387)

Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. 1101-1164)

Global Climate Protection Act of 1987 (15 U.S.C. 2901note)

Hazardous Substance Response Revenue Act of 1980 (see 26 U.S.C. 4611, 4612, 4661, 4662)

Lead-Based Paint Exposure Reduction Act (15 U.S.C. 2681-2692)

Lead Contamination Control Act of 1988 (42 U.S.C. 300j-21 to 300j-25)

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Low-Level Radioactive Waste Policy Act (42 U.S.C. 2021b-2021d)

Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. 1401-1445)

Mining and Mineral Resources Research Institute Act of 1984 (30 U.S.C. 1221-1230)

National Climate Program Act (15 U.S.C. 2901-2908)

National Contaminated Sediment Assessment and Management Act (33 U.S.C. 1271 note)

National Environmental Policy Act of 1969 (42 U.S.C. 4321-4370b)

Noise Control Act of 1972 (42 U.S.C. 4901-4918)

Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101-10270)

Oil Pollution Act of 1990 (33 U.S.C. 2701-2761)

Organotin Anti-Fouling Paint Control Act of 1988 (33 U.S.C. 2401-2410)

Outer Continental Shelf Land Act Amendments of 1978 (43 U.S.C. 1801-1866)

Pollution Prevention Act of 1990 (42 U.S.C. 13101-13109)

Public Health Service Act (42 U.S.C. 300f-300j-11)

Renewable Resources Extension Act of 1978 (16 U.S.C. 1671-1676)

Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901-6991)

Safe Drinking Water Act (see Public Health Service Act Sections 1401-1451 (42 U.S.C. 300f-300j-11))

Soil and Water Resources Conservation Act of 1977 (16 U.S.C. 2001-2009)

Solid Waste Disposal Act (42 U.S.C. 6901-6991i)

Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201-1328)

Toxic Substances Control Act (15 U.S.C. 2601-2692)

Uranium Mill Tailings Radiation Control Act of 1978 (42 U.S.C. 7901-7942)

Water Resources Research Act of 1984 (42 U.S.C. 10301-10309)

Wood Residue Utilization Act of 1980 (16 U.S.C. 1681-1687)

PART II – FEDERAL STATUTES - 2

ARCHITECTURAL WORKING DRAWING
ABBREVIATIONS

The following abbreviations shall not be considered all inclusive. Additional abbreviations not listed which have well known technical or trade meanings shall be used in accordance with such recognized meanings.

| | | | |
|--------|----------------------------------|-------|--|
| ☉ | CENTER OR CENTER LINE | CIP | CAST IRON PIPE |
| ☐ | PLATE | CIRC | CIRCULATING PUMP |
| A | AMPERE | CJ | CONTROL JOINT |
| A/C | AIR CONDITIONING | CLG | CEILING |
| AAT | AMBIENT AIR TEMPERATURE | CLO | CLOSET |
| AB | ANCHOR BOLT | CMP | CORRUGATED METAL PIPE |
| ABV | ABOVE | CMT | CERAMIC MOSAIC TILE |
| AC | AIR CONDITIONING | CMU | CONCRETE MASONRY UNIT |
| AC CMU | ACOUSTICAL CONCRETE MASONRY UNIT | CO | CLEANOUT |
| ACOUST | ACOUSTIC | COMB | COMBINATION |
| AD | AREA DRAIN | CONC | CONCRETE |
| AFF | ABOVE FINISHED FLOOR | CONST | CONSTRUCTION |
| ALT | ALTERNATE | CONT | CONTINUOUS |
| ALUM | ALUMINUM | CONTR | CONTRACT(OR) |
| AP | ACOUSTICAL PANEL | CORR | CORRIDOR |
| APD | AIR PRESSURE DROP | CS | COUNTERTOP SINK |
| APPROX | APPROXIMATE | CT | CERAMIC TILE |
| ARCH | ARCHITECT(URAL) | CT | CLEAR TEMPERED |
| B&B | BALLED AND BURLAPPED | CTI | CLEAR TEMPERED INSULATING |
| BD | BALANCING DAMPER | CTRL | CONTROL |
| BDD | BACKDRAFT DAMPER | CW | CHILLED WATER |
| BIT | BITUMINOUS | CW | COLD WATER |
| BLDG | BUILDING | CWR | CHILLED WATER RETURN |
| BLK'G | BLOCKING | CWS | CHILLED WATER SUPPLY |
| BLW | BELOW | DB | DRY BULB |
| BOC | BOTTOM OF CURB | DBA | DEFORMED BAR ANCHOR |
| BOD | BOTTOM OF DUCT | DEPT | DEPARTMENT |
| BOS | BOTTOM OF STEEL | DETS | DETAILS |
| BRK | BRICK | DF | DRINKING FOUNTAIN |
| BS | BAR SINK | DH | DUCT HEATER |
| BS | BOTH SIDES | DIAM | DIAMETER |
| BTU | BRITISH THERMAL UNIT | DIM'S | DIMENSIONS |
| BTUH | BRITISH THERMAL UNITS PER HOUR | DIP | DUCTILE IRON PIPE |
| BUR | BUILT-UP ROOF | DL | DOOR LOUVER |
| C | COURSES | DN | DOWN |
| CAB | CABINET | DO | DITTO |
| CARP | CARPET | DPR | DAMPER |
| CB | CATCH BASIN | DPRV | DIFFERENTIAL PRESSURE REGULATING VALVE |
| CFM | CUBIC FEET PER MINUTE | DR | DOOR |
| CH | CABINET HEATER | DTR | DUCT THRU ROOF |
| CI | CAST IRON | DW | DISHWASHER |
| CI | CLEAR INSULATING | DWGS | DRAWINGS |
| | | DX | DIRECT EXPANSION |

ARCHITECTURAL WORKING DRAWING ABBREVIATIONS - 1

| | | | |
|------------|--------------------------------------|----------|--|
| EA | EACH | GWT | GLAZED WALL TILE |
| EAT | ENTERING AIR TEMPERATURE | GYM | GYMNASIUM |
| EC | ELECTRICAL CONTRACTOR | GYP | GYPSUM |
| EER | ENERGY EFFICIENCY RATIO | H | FIXTURE FOR HANDICAPPED |
| EF | EXHAUST FAN | HB | HOSE BIBB |
| EIFS | EXTERIOR INSULATION FINISH SYSTEM | HC | HEATING CONTRACTOR |
| ELEC | ELECTRIC OR ELECTRICAL | HCP | HANDICAPPED |
| ELEV | ELEVATOR | HDPE | HIGH DENSITY POLYETHYLENE PIPE |
| ELEV'S | ELEVATIONS | HDWD | HARDWOOD |
| EPDM | ETHYLENE PROPYLENE DIENE MONOMER | HELV | HELVETICA |
| EPX | EPOXY COATING | HT | HEIGHT |
| EQ | EQUAL | HM | HOLLOW METAL |
| EQUIP | EQUIPMENT | HORIZ | HORIZONTAL |
| EWC | ELECTRIC WATER COOLER | HP | HIGH POINT |
| EWT | ENTERING WATER TEMPERATURE | HP | HORSEPOWER |
| EXH | EXHAUST | HTR | HEATER |
| EXIST | EXISTING | HVAC | HEATING, VENTILATING AND AIR CONDITIONING |
| EXP | EXPANSION | HW | HOT WATER |
| EXP STRUCT | EXPOSED STRUCTURE | HWH | HOT WATER HEATER |
| EXP TER | EPOXY TERRAZZO | HWR | HOT WATER RETURN |
| EXT | EXTERIOR | HWS | HOT WATER SUPPLY |
| F&B | FACE AND BYPASS | HZ | HERTZ |
| F&T | FLOAT AND TEMPERATURE | ID | INSIDE DIAMETER |
| F.T. | FIN TUBE RADIATION | IN | INCH |
| FAV | FRESH AIR VENT | INFO | INFORMATION |
| FC | FAN COIL UNIT | INSUL | INSULATED |
| FD | FLOOR DRAIN | INV | INVERT |
| FDN | FOUNDATION | JAN | JANITOR |
| FE | FIRE EXTINGUISHER | JAN CLOS | JANITOR'S CLOSET |
| FEC | FIRE EXTINGUISHER CABINET | JT | JOINT |
| FHC | FIRE HOSE CABINET | KW | KILOWATT |
| FIN | FINISHED | LAV | LAVATORY |
| FIN GR | FINISHED GRADE | LAV'S | LAVATORIES |
| FLA | FULL LOAD AMPS | LB | POUND |
| FLR | FLOOR | LH | LOUVER HOUSE INTAKE W/CURB ON ROOF |
| FLR MT | FLOOR MAT | LLH | LONG LEG HORIZONTAL |
| FPM | FEET PER MINUTE | LLV | LONG LEG VERTICAL |
| FS | FLOOR SINK | LP | LOW POINT |
| FS | FOOD SERVICE | LS | LAUNDRY SINK |
| FT | FOOT/FEET | LVR | LOUVER |
| FTG | FOOTING | MAT | MIXED AIR TEMPERATURE |
| FU | FIXTURE UNITS | MAX | MAXIMUM |
| GA | GAUGE | MB | MOP BASIN |
| GAL | GALLON | MBH | THOUSANDS OF BTU'S PER HOUR |
| GALV | GALVANIZED | MCA | MINIMUM CURRENT AMPACITY |
| GC | GENERAL CONTRACTOR | MD | MOTORIZED DAMPER |
| GH | GROUND HYDRANT | MECH | MECHANICAL |
| GL BLK | GLASS BLOCK | MFG | MANUFACTURING |
| GL | GLASS | MFR | MANUFACTURER |
| GPH | GALLONS PER HOUR | MH | MANHOLE |
| GWB | GYPSUM WALLBOARD | | |

ARCHITECTURAL WORKING DRAWING ABBREVIATIONS - 2

| | | | |
|----------|---------------------------|---------|--|
| MIN | MINIMUM | SEE | SEE EXTERIOR ELEVATION |
| MO | MASONRY OPENING | SIE | SEE INTERIOR ELEVATION |
| MTD | MOUNTED | | FOR ADDITIONAL INFORMATION |
| NC | NORMALLY CLOSED | SIM | SIMILAR |
| NIC | NOT IN CONTRACT | SLV | SLEEVE |
| NO | NUMBER | SP | STATIC PRESSURE |
| NTS | NOT TO SCALE | SPECS | SPECIFICATIONS |
| Ø | PHASE OR DIAMETER | SQ | SQUARE |
| OA | OUTSIDE AIR | SRCP | SEE REFLECTED CEILING PLAN FOR ADDITIONAL INFORMATION |
| OBD | OPPOSED BLADE DAMPER | | |
| OC | ON CENTER | SS | SERVICE SINK |
| OD | OUTSIDE DIAMETER | SS | STAINLESS STEEL |
| OFF | OFFICE | STL JST | STEEL JOIST |
| OPG | OPENING | STL | STEEL |
| OPP | OPPOSITE | STOR | STORAGE |
| P | PRESSURE GAGE | STRUCT | STRUCTURAL |
| PC | PIECE | SUS | SUSPENDED |
| PC | PLUMBING CONTRACTOR | SYM | SYMETRY/SYMETRICAL |
| PD | PRESSURE DROP | T | THERMOMETER |
| PH | POST HYDRANT | T&G | TONGUE AND GROOVE |
| PLAS LAM | PLASTIC LAMINATE | TB | TACKBOARD |
| PLY WD | PLYWOOD | TER | TERRAZZO |
| PNT | PAINT | TGL | TEMPERED GLASS |
| PRV | PRESSURE REDUCING VALVE | THK | THICK |
| PSF | POUNDS PER SQUARE FOOT | THRES | THRESHOLD |
| PSI | POUNDS PER SQUARE INCH | TLT | TOILET |
| PTD | PAINTED | TMV | THERMOSTATIC MIXING VALVE |
| PVC | POLYVINYL CHLORIDE | TOC | TOP OF CONCRETE OR CURB |
| PWT | PORCELAIN WALL TILE | TOF | TOP OF FOOTING |
| QT | QUARRY TILE | TOS | TOP OF STEEL |
| QTY | QUANTITY | TOW | TOP OF WALL |
| R | RISERS | TUB | BATHTUB |
| RA | RETURN AIR | TV | TELEVISION |
| RCP | REINFORCED CONCRETE PIPE | TYP | TYPICAL |
| RD | ROOF DRAIN | UC | UNDERCUT |
| RDO | ROOF DRAIN W/OVERFLOW | UH | UNIT HEATER |
| RE: | REFERENCE | UNO | UNLESS NOTED OTHERWISE |
| REFRIG | REFRIGERATOR | UR | URINAL |
| REINF | REINFORCED OR REINFORCING | UV | UNIT VENTILATOR |
| REQ'D | REQUIRED | V | VENT |
| RES FL | RESINOUS FLOORING | V | VOLT |
| RLF | RELIEF | VB | VINYL BASE |
| RM | ROOM | VCT | VINYL COMPOSITION TILE |
| RO | ROUGH OPENING | VERT | VERTICAL |
| ROW | RIGHT OF WAY | VEST | VESTIBULE |
| RV | RELIEF VENT | VIF | VERIFY IN FIELD |
| RWC | RAIN WATER CONDUCTOR | VP | VENEER PLASTER |
| S | SLOPE | VTR | ROOF VENT |
| S | SOIL LINE/STACK | VWF | VINYL WALL FABRIC |
| SAN | SANITARY | W | WASTE |
| SCHED | SCHEDULE | W/ | WITH |
| SD | SMOKE DETECTOR | WB | WET BULB |
| SECT | SECTION | WC | WATER CLOSET |

ARCHITECTURAL WORKING DRAWING ABBREVIATIONS - 3

| | |
|------------|------------------------|
| WD ATH FLR | WOOD ATHLETIC FLOORING |
| WD | WOOD |
| WF | WIDE FLANGE |
| WH | WALL HYDRANT |
| WP | WEATHERPROOF |
| WP | WORK POINT |
| WT | WEIGHT |
| WTW | WALL TO WALL |
| WWF | WELDED WIRE FABRIC |
| XP | EXPLOSION PROOF |
| YD | YARD |

ARCHITECTURAL WORKING DRAWING ABBREVIATIONS - 4

BRESLIN RIDYARD FADERO ARCHITECTS

AGREEMENT FOR DELIVERY OF ELECTRONIC DOCUMENTS WITH CONTRACTORS

At your request, we, Breslin Ridyard Fadero Architects, (hereinafter referred to as “Design Professional”), are providing to you, the following electronic files as indicated on the enclosed transmittal or email, for your use in coordinating background information for the preparation of coordination drawings for the project indicated on the transmittal. These documents shall hereinafter be referred to as the “Electronic Documents.” They are provided as a convenience to the recipient for the purpose of general coordination of background plan information for the preparation of coordination drawings. The recipient shall be responsible for the final coordination of plan background information and the coordination drawings with the final hard copy of the Design Professional’s project documents that include the Architect’s seal and are intended as the final construction documents.

1. It is understood and agreed that all drawings, specifications or other documents of any kind prepared by Design Professional or its subconsultants, whether in printed form or any electronic or machine readable format including (collectively the “Design Professional’s Documents”), are instruments of their services prepared solely for use in connection with the single project for which they were prepared and that the Design Professional and its subconsultants retain all common law, statutory and other reserved rights, including the copyright. Notwithstanding Design Professional’s agreement to release the Electronic Documents to Recipient, all Design Professionals Documents are and remain the property of the Design Professional and subconsultant.

2. Recipient understands and agrees that the conversion of printed copies of Design Professional’s Documents into electronic or machine readable format or the conversion of Electronic Documents from the machine readable format used by Design Professional to some other format may introduce errors or other inaccuracies. Recipient also understands electronic files will degrade over time. Recipient therefore agrees to confirm the accuracy of the Electronic Documents by comparing them to the printed copies of the Electronic Documents that are in the final construction documents and all subsequent addenda. Recipient agrees to accept all responsibility for any errors or inaccuracies and to release Design Professional and its subconsultants from any liability or claims for recovery of damages or expenses arising as the result of such errors or inaccuracies.

3. Recipient agrees not to add to, modify or alter in any way, or to allow others to add to, modify or alter in any way, any of the Design Professional’s or its subconsultant’s information provided the Electronic Documents or any of the Design Professional’s Documents except for the following: The Recipient may add electronic information, solely for the purpose of producing Coordination Drawings and in accordance with the Project Specifications, on new and distinct layers, added by each individual Recipient as authorized by this agreement. Each Recipient shall clearly identify the added information and clearly identify the layer(s) added by that Recipient in the name of the layer.

1226 UNION BOULEVARD, ALLENTOWN, PENNSYLVANIA 18109

TELEPHONE: 610-437-9626

TELEFAX: 610-437-4769

4. Upon completing the coordination drawings, a final electronic file shall be returned by the General Contractor to the Architect with all of the added electronic information by all of the recipients.

5. Recipient further agrees that the Design Professional's Documents were prepared for use in connection with this Project only and that the Electronic Documents are supplied to Recipient for the limited purpose stated above only. Recipient agrees not to use, or allow others to use, the Design Professional's Documents or the Electronic Documents, in whole or in part, for any purpose or project other than for the Project and for the purposes described above.

6. Recipient agrees to waive any and all claims and liability against the Design Professional and its subconsultants resulting in any way from any failure by Recipient to comply with the requirements of this Agreement for the Delivery of Documents in Electronic Format.

7. Recipient further agrees to indemnify and save harmless the Design Professional and its subconsultants and each of their partners, officers, shareholders, directors and employees from any and all claims, judgments, suits, liabilities, damages, costs, or expenses (including reasonable defense and attorney fees) arising as the result of the Recipient's use of the Electronic Documents or the Design Professional's Documents including Recipient's failure to comply with any of the requirements of Agreement for the Delivery of Documents in Electronic Format.

Name:
Title:
Company:

Date: _____

Name:
Title:
Company:

Date: _____

Name:
Title:
Company:

Date: _____

Name:
Title:
Company:

Date: _____

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SUBSTITUTION REQUEST FORM

- A. Submissions for approved substitutions will be permitted and processed in accord with Paragraph 29 of the “Instructions to Bidders” and Section 012500 “Substitution Procedures.”
- B. Submissions will be "received dated" immediately upon arrival at the office of Breslin Ridyard Fadero Architects.
- C. All Submissions must be received ten (10) days prior to the bid date or they may not be reviewed.
- D. Reviewer's General Criteria for review will be:
 - 1. Burden of proof of performance equality and completeness of this submittal is the responsibility of the submitter.
 - 2. Reviewers will not be required to complete the submittal, that is, select from options or between models and lines of products.
 - 3. Reviewer will not be required to seek information from the manufacturer's literature on file in the office, or information from other locations.
 - 4. Product must be equal, or better, in those features and performance which specified product provides.
 - 5. When in the reviewer's opinion, significant deficiencies are established, further review of submitted data is not required.
- E. Reviewer will note action (approval or disapproval), the date, and their initials.
- F. If a submittal is disapproved, reviewer will make notations that will be adequate to guide a later reviewer to the same conclusion. Sample notations may be: "Submittal vague", "incomplete", or "product equality not substantiated".
- G. Submittals received after closing time will be "received dated," marked "late", initialed, and filed without review.
- H. Submittals will be filed in the project file until completion of the project, then destroyed.
- I. Approval of a substitute item will be communicated to bidders in the form of an Addendum.

**EXHIBIT “B”
SUBSTITUTION REQUEST FORM - 1**

TO: Breslin Ridyard Fadero Architects
1226 Union Boulevard
Allentown, Pennsylvania 18109

PROJECT _____

PRIME BIDDER _____

CONTRACTOR/SUPPLIER _____

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

| SECTION/DRAWING | PARAGRAPH/DETAIL | SPECIFIED ITEM |
|------------------------|-------------------------|-----------------------|
| _____ | _____ | _____ |

Proposed Substitution: _____

MANUFACTURER'S HOME OFFICE:

LOCAL REPRESENTATIVE:

Address: _____

Address: _____

Telephone: _____

Telephone: _____

Contact: _____

Contact: _____

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

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

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

Reason for Substitution: _____

EXHIBIT "B"
SUBSTITUTION REQUEST FORM - 2

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

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

No. 2 Drawings indicating dimensional changes. _____

No. 3 Complete description of changes to Drawings and Specifications that proposed substitution will require for its proper installation.

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

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

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

A. Does the substitution affect dimensions indicated on the Contract Drawings?

Yes _____ No _____ If yes, clearly indicate changes:

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

C. What effect does substitution have on other trades, other contracts, and Contract Completion Date?

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

E. List differences between proposed substitution and specified item:

F. Identify manufacturer's guarantees: _____

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

**EXHIBIT "B"
SUBSTITUTION REQUEST FORM - 3**

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

CERTIFICATION OF EQUAL PERFORMANCE:

Submitted by: _____ Title: _____

Company: _____

Address: _____

Date: _____

Telephone: _____ E-mail: _____

Signature: _____

For Use by the Architect/Engineer:

Accepted _____ Accepted as Noted: _____

Not Accepted _____ Received Too Late: _____

Reviewer: _____ Date: _____

REMARKS: _____

**EXHIBIT "B"
SUBSTITUTION REQUEST FORM - 4**

Request for Interpretation/Information (RFI)

PROJECT (*Name and address*):
Interior Alterations – Phase 3
Eastern Center for Arts and Technology

RFI NUMBER:
RFI SUBJECT:

OWNER:
ARCHITECT:
CONSULTANT:
CONTRACTOR:
OTHER:

TO (*Name and address*):

ARCHITECT'S PROJECT NUMBER: 694
DATE RECEIVED:
DATE RESPONDED:

ATTENTION:

CONTRACT FOR:

SPEC SECTION

PARAGRAPH

DRAWING NO.

DETAIL NO.

REQUEST:

ATTACHMENTS

SIGNED BY:

RESPONSE:

ATTACHMENTS

Breslin Ridyard Fadero
ARCHITECT (*Firm name*)

1226 Union Boulevard
Allentown, Pennsylvania 18109
ADDRESS

BY (*Signature*)

(*Typed name*)

DATE

EXHIBIT "C"
REQUEST FOR INTERPRETATION/INFORMATION (RFI) - 1

Certification of Punchlist Completion

PROJECT: Interior Alterations – Phase 3
Eastern Center for Arts and Technology

PROJECT NUMBER: 694

(Name and address):

CONTRACT FOR:

CONTRACTOR
(Name and address):

DATE:

The undersigned Contractor certifies that in accordance with the Contract all the punchlists listed below and hereto attached have been completed.

Punchlist(s):

CONTRACTOR

BY

DATE

Notary Public

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

My commission expires:

**EXHIBIT “D”
CERTIFICATION OF PUNCHLIST COMPLETION - 1**

**PENNSYLVANIA STATE POLICE
REQUEST FOR CRIMINAL RECORD CHECK
1-888-QUERYPA (1-888-783-7972)**

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

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

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

| |
|---|
| FOR CENTRAL REPOSITORY USE ONLY CONTROL NUMBER |
| AFTER COMPLETION MAIL TO: PENNSYLVANIA STATE POLICE CENTRAL REPOSITORY – 164 1800 ELMERTON AVENUE HARRISBURG, PA 17110-9758 DO NOT SEND CASH OR PERSONAL CHECK |
| CHECK ONE BLOCK <input type="checkbox"/> INDIVIDUAL/NONCRIMINAL JUSTICE AGENCY – ENCLOSE A CERTIFIED CHECK/MONEY ORDER IN THE AMOUNT OF \$22.00, PAYABLE TO: “COMMONWEALTH OF PENNSYLVANIA” THE FEE IS NONREFUNDABLE <input type="checkbox"/> NOTARIZED INDIVIDUAL/NONCRIMINAL JUSTICE AGENCY – ENCLOSE A CERTIFIED CHECK/MONEY ORDER IN THE AMOUNT OF \$27.00, PAYABLE TO: “COMMONWEALTH OF PENNSYLVANIA” THE FEE IS NONREFUNDABLE <input type="checkbox"/> FEE EXEMPT-NONCRIMINAL JUSTICE AGENCY – NO FEE |

| | | | | |
|--------------------------------|------------------------|----------------------------|-----|------|
| SUBJECT OF RECORD CHECK | | | | |
| (FIRST) | (MIDDLE) | (LAST) | | |
| MAIDEN NAME AND/OR ALIASES | SOCIAL SECURITY NUMBER | DATE OF BIRTH (MM/DD/YYYY) | SEX | RACE |

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

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

| | | | | |
|--|---|--------------------------|--------------------------|--------------------------|
| REASON FOR REQUEST | | | | |
| ◀◀◀◀◀CHECK THE BOX THAT MOST APPLIES TO THE PURPOSE OF THIS REQUEST▶▶▶▶▶ | | | | |
| <input type="checkbox"/> | INTERNATIONAL ADOPTION - INTERNATIONAL ADOPTION MUST BE NOTARIZED AND MAILED IN. (\$27.00 FOR REQUEST) | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| ADOPTION (DOMESTIC) | EMPLOYMENT | VISA | OTHER | |

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

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

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

Section 1. Personal Information

Full Legal Name: _____

Date of Birth: ____/____/____

Other names by which you have been identified: _____

Section 2. Arrest or Conviction

- By checking this box, I state that I have NOT been arrested for or convicted of any Reportable Offense.
- By checking this box, I report that I have been arrested for or convicted of an offense or offenses enumerated under 24 P.S. §§1-111(e) or (f.1) ("Reportable Offense(s)"). See Page 3 of this Form for a list of Reportable Offenses.

Details of Arrests or Convictions

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

Section 3. Child Abuse

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

Section 4. Certification

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

Signature

Date

INSTRUCTIONS

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

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

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

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

PROVIDE ALL INFORMATION REQUIRED BY THIS FORM LEGIBLY IN INK.

LIST OF REPORTABLE OFFENSES

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

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

| | |
|---|---|
| <ul style="list-style-type: none"> ▪ Chapter 25 (relating to criminal homicide) ▪ Section 2702 (relating to aggravated assault) ▪ Section 2709.1 (relating to stalking) ▪ Section 2901 (relating to kidnapping) ▪ Section 2902 (relating to unlawful restraint) ▪ Section 2910 (relating to luring a child into a motor vehicle or structure) ▪ Section 3121 (relating to rape) ▪ Section 3122.1 (relating to statutory sexual assault) ▪ Section 3123 (relating to involuntary deviate sexual intercourse) ▪ Section 3124.1 (relating to sexual assault) ▪ Section 3124.2 (relating to institutional sexual assault) ▪ Section 3125 (relating to aggravated indecent assault) ▪ Section 3126 (relating to indecent assault) ▪ Section 3127 (relating to indecent exposure) ▪ Section 3129 (relating to sexual intercourse with animal) ▪ Section 4302 (relating to incest) ▪ Section 4303 (relating to concealing death of child) | <ul style="list-style-type: none"> ▪ Section 4304 (relating to endangering welfare of children) ▪ Section 4305 (relating to dealing in infant children) ▪ A felony offense under section 5902(b) (relating to prostitution and related offenses) ▪ Section 5903(c) or (d) (relating to obscene and other sexual materials and performances) ▪ Section 6301(a)(1) (relating to corruption of minors) ▪ Section 6312 (relating to sexual abuse of children) ▪ Section 6318 (relating to unlawful contact with minor) ▪ Section 6319 (relating to solicitation of minors to traffic drugs) ▪ Section 6320 (relating to sexual exploitation of children) |
|---|---|
- (2) An offense designated as a felony under the act of April 14, 1972 (P.L. 233, No. 64), known as “The Controlled Substance, Drug, Device and Cosmetic Act.”
- (3) An offense SIMILAR IN NATURE to those crimes listed above in clauses (1) and (2) under the laws or former laws of:
 - the United States; or
 - one of its territories or possessions; or
 - another state; or
 - the District of Columbia; or
 - the Commonwealth of Puerto Rico; or
 - a foreign nation; or
 - under a former law of this Commonwealth.

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

- (1) An offense graded as a felony offense of the first, second or third degree, other than one of the offenses enumerated under 24 P.S. §1-111(e), if less than (10) ten years has elapsed from the date of expiration of the sentence for the offense.
- (2) An offense graded as a misdemeanor of the first degree, other than one of the offenses enumerated under 24 P.S. §1-111(e), if less than (5) five years has elapsed from the date of expiration of the sentence for the offense.
- (3) An offense under 75 Pa.C.S. § 3802(a), (b), (c) or (d) (relating to driving under influence of alcohol or controlled substance) graded as a misdemeanor of the first degree under 75 Pa.C.S. § 3803 (relating to grading), if the person has been previously convicted of such an offense and less than (3) three years has elapsed from the date of expiration of the sentence for the most recent offense.

PENNSYLVANIA CHILD ABUSE HISTORY CERTIFICATION

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

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

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

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

PURPOSE OF CERTIFICATION (Check one box only)

- | | |
|---|---|
| <input type="checkbox"/> Foster parent <input type="checkbox"/> Prospective adoptive parent <input type="checkbox"/> Employee of child care services <input type="checkbox"/> School employee governed by the Public School Code <input type="checkbox"/> School employee not governed by the Public School Code <input type="checkbox"/> Self-employed provider of child-care services in a family child-care home <input type="checkbox"/> An individual 14 years of age or older applying for or holding a paid position as an employee with a program, activity, or service <input type="checkbox"/> An individual seeking to provide child-care services under contract with a child care facility or program <input type="checkbox"/> An individual 18 years or older who resides in the home of a foster parent for children for at least 30 days in a calendar year <input type="checkbox"/> An individual 18 years or older who resides in the home of a certified or licensed child-care provider for at least 30 days in a calendar year <input type="checkbox"/> An individual 18 years or older, excluding individuals receiving services, who resides in a family living home, community home for individuals with an intellectual disability, or host home for children for at least 30 days in a calendar year <input type="checkbox"/> An individual 18 years or older who resides in the home of a prospective adoptive parent for at least 30 days in a calendar year | <input type="checkbox"/> Volunteer having direct volunteer contact with children <p style="margin-left: 20px;">If purpose is volunteer having direct volunteer contact with children, choose SUB PURPOSE:</p> <input type="checkbox"/> Big Brother/Big Sister and/or affiliate <input type="checkbox"/> Domestic violence shelter and/or affiliate <input type="checkbox"/> Rape crisis center and/or affiliate <input type="checkbox"/> Other: _____ <input type="checkbox"/> PA Department of Human Services Employment & Training Program participant (signature required below) |
|---|---|

SIGNATURE OF OIM/CAO REPRESENTATIVE

OIM/CAO PHONE NUMBER

AGENCY/ORGANIZATION NAME:

PAYMENT AUTHORIZATION CODE, IF APPLICABLE:

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

APPLICANT DEMOGRAPHIC INFORMATION (DO NOT USE INITIALS)

| | | | |
|-------------------------------------|--|----------------------------|--------|
| FIRST NAME | MIDDLE NAME | LAST NAME | SUFFIX |
| SOCIAL SECURITY NUMBER — — — — — | GENDER <input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Not reported | DATE OF BIRTH (MM/DD/YYYY) | AGE |

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

| HOME ADDRESS | MAILING ADDRESS (if different from home address) | OTHER ADDRESS (if Consent/Release of Information Authorization form is attached) |
|--|---|--|
| ADDRESS LINE 1 | ADDRESS LINE 1 | ADDRESS LINE 1 |
| ADDRESS LINE 2 | ADDRESS LINE 2 | ADDRESS LINE 2 |
| CITY | CITY | CITY |
| COUNTY | COUNTY | COUNTY |
| STATE/REGION/PROVINCE | STATE/REGION/PROVINCE | STATE/REGION/PROVINCE |
| ZIP/POSTAL CODE | ZIP/POSTAL CODE | ZIP/POSTAL CODE |
| COUNTRY | COUNTRY | COUNTRY |
| <input type="checkbox"/> Different mailing address | ATTENTION | ATTENTION |

CONTACT INFORMATION

| | | |
|---|-----------------------|-------------------------|
| HOME TELEPHONE NUMBER | WORK TELEPHONE NUMBER | MOBILE TELEPHONE NUMBER |
| EMAIL (By submitting an email contact, you are agreeing to ChildLine contacting you at this address.) | | |

PENNSYLVANIA CHILD ABUSE HISTORY CERTIFICATION

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

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

| HOUSEHOLD MEMBERS (Please list everyone who lived with you at any time since 1975 to present. Please include parent, guardian or the person(s) who raised you; attach additional pages as necessary.) | | | | |
|---|---|-------------|--------|--|
| Name (First, Middle, Last) | Relationship | Present Age | Gender | |
| 1. | <input type="checkbox"/> Parent <input type="checkbox"/> Guardian <input type="checkbox"/> person(s) who raised you | | | |
| 2. | <input type="checkbox"/> Parent <input type="checkbox"/> Guardian <input type="checkbox"/> person(s) who raised you | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |
| 6. | | | | |
| 7. | | | | |
| 8. | | | | |
| 9. | | | | |
| 10. | | | | |

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

APPLICANT'S SIGNATURE
DATE

| CHILDLINE USE ONLY | | |
|----------------------------|---|--------------------|
| DATE RECEIVED BY CHILDLINE | SUFFICIENT PAYMENT INFORMATION RECEIVED <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> VALID PAYMENT AUTHORIZATION CODE <input type="checkbox"/> WAIVED (supervisor initials) _____ | CERTIFICATION ID # |

INSTRUCTIONS TO COMPLETE THE PENNSYLVANIA CHILD ABUSE HISTORY CERTIFICATION APPLICATION:

General:

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

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

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

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

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

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

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

Applicant Demographic Information:

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

Address:

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

Contact Information:

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

Previous Names Used Since 1975:

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

Previous Addresses Since 1975:

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

Household Members:

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

Signature:

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

CHILDLINE USE ONLY:

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

Additional Information:

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



COMMONWEALTH OF PENNSYLVANIA

PUBLIC WORKS EMPLOYMENT VERIFICATION FORM

Business or Organization Name (Employer) _____

Address _____

City _____ State _____ Zip Code _____

Check One:

- Contractor
- Subcontractor

Contracting Public Body _____

Contract/Project No _____

Project Description _____

Project Location _____

Date Enrolled in E-Verify: _____

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

Date of Signature

Fingerprint Service Code Form

Service Name: School Districts

To Schedule your ten-minute fingerprint appointment, simply visit <https://uenroll.identogo.com> and enter the following Service Code

1KG6XN

Service Code is unique to your hiring/licensing agency. Do not use this code for another purpose.

Please bring one of the identification documents from the list below to your enrollment appointment.

- Driver's License issued by a State or outlying possession of the U.S.
- Driver's License PERMIT issued by a State or outlying possession of the U.S.
- ID card issued by a federal, state, or local government agency or by a Territory of the United States
- State ID Card (or outlying possession of the U.S.) with a seal or logo from State or State Agency
- Commercial Driver's License issued by a State or outlying possession of the U.S.
- Canadian Driver's License
- Department of Defense Common Access Card
- Employment Authorization Card/ Document (I-766) with Photo
- Foreign Driver's License (Mexico and Canada only)
- Foreign passport
- Military Dependent's Identification Card
- Permanent Resident Card or Alien Registration Receipt Card (Form I-551)
- U.S. Coastguard Merchant Mariner Card
- U.S. Military Identification Card
- U.S. Passport
- Enhanced Tribal Identification Card (for federally recognized U.S. tribes)
- U.S. Visa issued by the U.S. Department of Consular Affairs for travel to or within, or residence within, the United States
- Uniformed Services Identification Card (Form DD-1172-2)
- Photo ID Waiver for Minors and U.S. Social Security Card or Birth Certificate



Don't have access to the Internet? You can still schedule an appointment by calling **844-321-2101**

**CERTIFICATE OF
SUBSTANTIAL COMPLETION**

AIA DOCUMENT G704

(Instructions on reverse side)

OWNER
ARCHITECT
CONTRACTOR
FIELD
OTHER

PROJECT:
(Name and address)

PROJECT NO.:

CONTRACT FOR:
CONTRACT DATE:

TO OWNER:
(Name and address)

TO CONTRACTOR:
(Name and address)

DATE OF ISSUANCE:
PROJECT OR DESIGNATED PORTION SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found, to the Architect's best knowledge, information and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion thereof designated above is hereby established as

which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

ARCHITECT BY _____ DATE _____

The Contractor will complete or correct the Work on the list of items attached hereto within _____ days from the above date of Substantial Completion.

CONTRACTOR BY _____ DATE _____

The Owner accepts the Work or designated portion thereof as substantially complete and will assume full possession thereof at _____ (time) on _____ (date).

OWNER BY _____ DATE _____

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



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G704-1002

EXHIBIT "J"
CERTIFICATE OF SUBSTANTIAL COMPLETION G704 - 1

INSTRUCTION SHEET

FOR AIA DOCUMENT G704, CERTIFICATE OF SUBSTANTIAL COMPLETION

A. GENERAL INFORMATION

1. Purpose

This document was developed to establish the date of Substantial Completion for the purpose of commencement of applicable warranties and to allow the Owner to occupy or utilize the Work or designated portion thereof.

2. Related Documents

This document was prepared for use under the terms of AIA Document A201, General Conditions of the Contract for Construction; under the general conditions contained in AIA Documents A107 and A117; and under other AIA general conditions beginning with the 1987 editions.

3. Use of Current Documents

Prior to using any AIA document, the user should consult the AIA, an AIA component chapter or a current AIA Documents List to determine the current edition of each document.

4. Limited License for Reproduction

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A limited license is hereby granted to retail purchasers to reproduce a maximum of ten copies of a completed or executed G704, but only for use in connection with a particular Project.

B. COMPLETING THE G704 FORM

1. After the words "Project or Designated Portion shall include:", insert a detailed description of the Project or portion(s) of the Project that have been accepted as being substantially complete.
2. Determine Work to be completed.
Provide a list of items that are to be completed or corrected.
Determine dates for completion of the Work.
Establish an amount to be withheld to complete the Work.

C. EXECUTION OF THE DOCUMENT

The G704 document should be executed in not less than triplicate by the Owner, Architect and Contractor, each of whom retains an original.

Reprinted 10/93

EXHIBIT "J" CERTIFICATE OF SUBSTANTIAL COMPLETION G704 - 2

SECTION 011000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Work covered by Contract Documents.
2. Work under separate contracts.

1.3 PROJECT INFORMATION

- A. Project Identification: The project shall consist of interior alterations Work of approximately 9,920 square feet at the Eastern Center for Arts and Technology Building as shown on the Contract Documents prepared by Breslin Ridyard Fadero Architects dated February 01, 2022.
- B. Owner: Eastern Center for Arts and Technology, 3075 Terwood Road, Willow Grove, Pennsylvania 19090. Telephone: 215-784-4800.
- C. Architect: Breslin Ridyard Fadero Architects, 1226 Union Boulevard, Allentown, Pennsylvania 18109. Telephone: 610-437-9626.
- D. MEP Consulting Engineer: Lehigh Valley Engineering, 1 West Broad Street, Suite 500, Bethlehem, Pennsylvania 18018. Telephone: 610-866-3820.
- E. Prime Contracts are separate contracts that represent significant construction activities performed concurrently with and closely coordinated with construction activities performed on the Project under other prime Contracts. Prime Contracts for this Project include:
1. General Construction Contract.
 2. Mechanical Construction Contract.
 3. Electrical Construction Contract.

1.4 PRIME CONTRACT SUMMARY

- A. Prime Contract Work: Each Prime Contract can be summarized as follows:

SUMMARY OF WORK

011000 - 1

- B. General Construction Contract: The Work under this Contract for Construction includes architectural construction and other activities traditionally recognized as general construction required by any of the Contract Documents including, but not limited to, the Architectural Drawings, Specification Divisions 01 through 14, except when specifically assigned to another Contract for Construction. The Work includes, but is not limited to, the following:
1. Minor Exterior and Interior Alteration Work shall include, but is not limited to, the following:
 - a. Selective demolition as indicated.
 - b. Miscellaneous cast-in-place concrete.
 - c. Minor asphalt paving repair where new concrete pads and new pipe bollards have been installed as indicated.
 - d. Hydraulic cement underlayment.
 - e. Unit masonry assemblies with steel lintels and reinforcing/bracing as required for masonry partitions.
 - f. New metal wall panel. (Areas of exterior wall repair where existing doors and garage doors have been removed where indicated on Drawings).
 - g. Metal fabrications including pipe bollards.
 - h. Reinforcement of existing steel roof trusses.
 - i. Miscellaneous rough carpentry.
 - j. Hollow metal doors, hollow metal frames, glazing for sidelights, hardware for doors, and panel signage at doors.
 - k. Exterior overhead coiling door.
 - l. Joint sealants.
 - m. Interior finishes including, but not limited to, gypsum board enclosures, epoxy flooring, resilient flooring and rubber base, acoustical tile ceiling system, and paint finishes.
 - n. Markerboards/tackboards.
 - o. Metal lockers.
 - p. Chainlink fences and gates.
 2. Mechanical Construction Contract: The Work under this Contract for Construction includes all construction and other activities traditionally recognized as Mechanical work and minor Plumbing work required by any of the Contract Documents including, but not limited to the

Mechanical Drawings, Plumbing Drawings, Specification Division 01, except when specifically assigned to another Contract for Construction. The Mechanical Construction Contract shall include all “P” and “H” Drawings and the terms “PC”, “HC”, and “MC” are all one and the same. The Work includes, but is not limited to, the following:

- a. Selective demolition of existing Heating, Ventilating, and Air-Conditioning (aka, HVAC) Systems.
 - b. Selective demolition of existing Plumbing Systems.
 - c. Incidental cutting and patching of existing walls, ceilings, and roof decks pertaining to the installation of mechanical systems.
 - d. Installation of rooftop and indoor air handling units including roof curbs, ductwork, piping, and automatic temperature controls.
 - e. Installation of ductwork, air terminal units, and duct accessories for air systems including all grilles, registers and diffusers.
 - f. Installation of dust collectors, exhaust fans, welding fume extractor arms, filter housings, relief air hoods and intakes, and roof curbs.
 - g. Installation of plumbing fixtures, domestic water piping, and sanitary waste and vent piping systems.
 - h. Installation of compressed air piping, welding gas piping, valves, and accessories including pipe hangers.
 - i. Installation of HVAC piping including valves, insulation, and pipe hangers.
 - j. Installation of thermal and acoustical insulation for ductwork, and associated equipment.
 - k. Installation of automatic temperature control devices including modifications to existing building management and control systems.
 - l. HVAC system Testing, Adjusting and Balancing.
3. Electrical Construction Contract: The Work under this Contract for Construction includes all construction and other activities traditionally recognized as electrical work required by any of the Contract Documents including, but not limited to, the electrical drawings, specification Divisions 01, except when specifically assigned to another Contract for Construction. The Work includes, but is not limited to, the following:
- a. Disconnect and remove lighting, lighting controls, electrical equipment, wiring devices, selected low voltage systems, and connections to equipment and associated raceways and wiring.

- b. Incidental cutting and patching of existing floors, walls, and ceilings pertaining for the removal or installation of electrical systems.
 - c. Lighting, lighting controls, receptacles, selected low voltage systems, and connections to equipment.
 - d. Modifications to existing power distribution system, new power equipment, busways and devices.
 - e. Grounding and bonding for a welding area.
 - f. Final connections to all equipment by others, unless otherwise noted.
 - g. Additions to the communications cabling systems.
 - h. Modification of the existing addressable fire alarm system conforming to NFPA and local codes.
 - i. Emergency lighting system for the renovated areas. Emergency lighting in all code required areas.
 - j. Electrical work includes testing, adjusting, and placing in operation all devices, equipment and systems installed.
- C. Definition of the extent of Contract Work: The extent of the Prime Contract Work is indicated in the Contract Documents. Except where no other more specific description is contained in the Contract Documents, general names and terminology on the Drawings and in Specification Sections determines which Contract includes a specific element of Work.
- 1. Local custom and trade-union jurisdictional settlements do not control the scope-of-Work included in each section of the work. When a potential jurisdictional dispute or similar interruption of construction activities is first identified or threatened, the Contractor shall promptly negotiate a reasonable settlement to avoid or minimize the pending interruption and its delays.

1.5 WORK SEQUENCE

- A. The Work shall be conducted as hereinafter specified and in the specified time of completion as follows:
- 1. Notice to Proceed: On or before April 01, 2022.
 - 2. Start On-Site Construction:
 - a. Phase 1 – Welding Area: April 11, 2022.
 - b. Phase 2 – Protective Services/Exercise Science Areas: June 06, 2022.

3. Substantial Completion:
 - a. Phase 1 – Welding Area: August 24, 2022.
 - b. Phase 2 – Protective Services/Exercise Science Areas: August 26, 2022.
 4. Final Completion: September 26, 2022 for Phase 1 and Phase 2 areas.
- B. Each Prime Contractor shall be responsible for reviewing the Contract Drawings and construction schedule to determine its effect on their work as it relates to the scope of work for temporary protection, temporary utilities, capping-off of existing utilities, material deliveries, manpower schedule, etc.
- C. The construction schedule and coordination and sequence of work shall be in full compliance with the project milestone dates. Liquidated damages will be assessed against contractors delaying completion of any designated milestone date.
- D. Work in the building shall be performed in a sequence to ensure that all building systems are systematically installed in an efficient manner. The mechanical and electrical rooms shall be constructed in an early sequence to permit rough-in.

1.6 USE OF PREMISES

- A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
1. The work hours must comply with local township ordinances.
 2. Perform the Work so as not to interfere with Owner's operations, or public access.
 3. Contractor shall comply with all Intermediate Unit regulations and policies while on their property, as well as any special regulations adopted by the Owner relating to this Project. Contractor, subcontractors, and their agents and employees shall not socialize with students, faculty, or staff.
 4. Comply with Intermediate Unit tobacco policies. In any case, smokeless tobacco use and smoking in any form, including vaping, is prohibited on the Intermediate Unit site

1.7 OWNER OCCUPANCY

- A. A Certificate of Substantial Completion will be executed for the Owner's occupancy at the completion of each phase.
- B. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.

- C. Prior to partial Owner occupancy at the completion of the Work, mechanical, fire protection, and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building except for warranty items.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION (Not applicable)

END OF SECTION 011000

SECTION 012200 – UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Refer to “General Conditions of the Contract” for procedures for submitting and handling Change Orders and Construction Change Directives.

1.3 DEFINITIONS

- A. Unit Price: Unit Price is stated on the Bid Form – Proposal as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: The Architect will verify units of measurement with the Contractor. Refer to individual Specification Sections for work that requires establishment of Unit Prices. Methods of measurement and payment for Unit Prices are specified in those Sections.
- C. Specification Sections should be referenced for requirements and materials described under each Unit Price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Refer to each individual Construction Bid Form – Proposal for schedule of Unit Prices pertaining to that particular Contract.

END OF SECTION 012200

SECTION 012300 – ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing Alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form-Proposal for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
1. The cost or credit for each Alternate is the net addition to or deduction from the Contract Sum to incorporate Alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate the Work of the Alternate into Project.
1. Include as part of each alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not indicated as part of Alternate.
- B. Notification: Immediately following award of the Contract, the Architect shall notify each party involved, in writing, of the status of each Alternate. Indicate whether Alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to Alternates.
- C. Execute accepted Alternates under the same conditions as other Work of this Contract including project schedule, milestones, and phases required for completion of the Work.

- D. Schedule: Specification Sections and Drawings contain requirements for materials and systems necessary to achieve the Work described under each Alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Refer to General Construction Bid Form, HVAC Construction Bid Form, and Electrical Construction Bid Form for Schedule of all Alternates.

END OF SECTION 012300

SECTION 012500 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
1. Multiple Prime Contracts: Provisions of this Section apply to each Prime Contractor.
- B. Related Requirements:
1. Bidding Requirements Section “Instructions to Bidders” for additional procedural requirements for substitutions.

1.3 DEFINITIONS

- A. Substitutions: Requests for changes proposed by Contractor in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor are considered requests for "Substitutions" prior to receipt of Bids.

1.4 SUBSTITUTIONS

- A. Pre-Bid Substitution Requests: Submit one copy of each Pre-bid Substitution Request not later than 10 days prior to receipt of Bids for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Refer to “Exhibit B” Substitution Request Form in the Non-Technical Specifications.
2. Documentation: Show compliance with requirements for substitutions and the following as applicable:
- a. Product data, including drawings and descriptions of products and fabrication and installation procedures.
- b. Samples, where applicable or requested.

- c. Detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, warranties, and specific features and requirements indicated.
 - d. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate Prime Contractors, that will be necessary to accommodate proposed substitution.
 - e. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including the effect on the overall Contract Time.
 - 1) If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - f. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of Architects and Owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or (7) days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Addendum.
 - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated from the information provided it will be rejected.

1.5 SUBSTITUTIONS AFTER EXECUTION OF THE AGREEMENT

- A. Substitution of Materials: No substitutions of materials will be considered after the Execution of the Contract without a Credit to the Owner, unless a Product becomes unavailable through no fault of the Contractor.
- B. No action to review the proposed substitution will be taken by the Architect or Engineer until the Contractor has submitted the following:
 - 1. A letter itemizing the proposed credit to Owner.
 - 2. A copy of the warranty.
 - 3. A summary of the schedule impact.
 - 4. Properly executed Exhibit “B” Document, Substitution Request Form.
- C. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request as included above, or when acceptance will require revision to the Contract Documents.
- D. In submitting a substitution request the Contractor acknowledges that:
 - 1. The Contractor shall coordinate installation of the substitution including modifications to other Work.
 - 2. The use of this Substitution will not adversely affect the Project Schedule.
 - 3. If modifications to the work of this contract or another contract are required because of the substitution these modifications shall be made at no additional cost to Owner.
 - 4. The Contractor waives all rights to claims for additional costs or time extension that may subsequently become apparent.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 013100 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. General coordination procedures.
 2. Requests for Information (RFIs).
 3. Project meetings.
- B. Related Requirements:
1. Section 017300 "Execution" for procedures for coordinating product installation, cutting and patching, protection, and progress cleaning.
 2. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract including Substantial Completion and Final Completion procedures, warranties and final cleaning.

1.3 SUBMITTALS

- A. Key Personnel Names: Within 15 days of "Notice to Proceed," submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including office, cellular telephone numbers and e-mail addresses. Include emergency telephone numbers for non-working hours.
1. Provide list to Owner, Architect and all Prime Contractors.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Each Prime Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: The General Contractor shall 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.
- D. Conservation: All Prime Contractors shall coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.5 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, each Prime Contractor shall prepare and submit an RFI in the form specified.
1. 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.
 - 1. RFI Form: Request for Interpretation/Information (RFI) attached to this Specification.
 - 2. Attachments shall be electronic files in Adobe Acrobat PDF format.
- C. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly with not less than the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number and description.
 - 5. Date the RFI was submitted.
 - 6. Date Architect's response was received.

1.6 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. The meeting will review responsibilities and personnel assignments and other pertinent issues of the project.
 - 1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Prime Contractor(s) and their superintendent; major subcontractors; and other concerned parties shall attend the conference.

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 processing Applications for Payment.
 - g. Distribution of the Contract Documents.
 - h. Submittal procedures.
 - i. Preparation of record documents.
 - j. Use of the premises.
 - k. Working hours.
 - l. Owner's occupancy requirements.
 - m. Responsibility for temporary facilities and controls.
 - n. Procedures for disruptions and shutdowns.
 - o. Construction waste management and recycling.
 - p. Parking availability.
 - q. Equipment deliveries and priorities.
 - r. Project safety and first aid.
 - s. Progress cleaning.
 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Progress Meetings: Architect will conduct Progress Meetings at biweekly intervals.
1. Attendees: In addition to representatives of Owner and Architect, each Prime Contractor, subcontractor, 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.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Temporary facilities and controls.
 - 7) Progress cleaning.
 - 8) Quality and work standards.
 - 9) Field observations.
 - 10) Review of open RFI's.
 - 11) Pending changes.
 - 12) Status of Change Orders.
 - 13) Site security and safety issues.
 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. Contractor shall revise 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.
- D. Coordination Meetings: General Contractor shall conduct Project coordination meetings at weekly intervals.
1. Attendees: In addition to representatives of the Owner, each Prime Contractor, and subcontractor responsible for work in the upcoming two weeks to be represented.
 2. Agenda: Review the work planned in the next two weeks and other items that may effect work in the short term including:
 - a. Deliveries.
 - b. Subcontractors working at the site.

- c. Construction area cleanliness.
 - d. Planned work hours.
 - e. Coordination items.
3. At each coordination meeting, each Prime Contractor is to provide a written two week look ahead schedule to the General Contractor and Owner for review and comment.
 4. The General Contractor shall write meeting minutes for each coordination meeting and distribute them to each Prime Contractor and to the Owner for review within two days after the meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 – PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - a. Contractor's Construction Schedule.
 - b. Daily construction reports.
2. The General Contractor shall be the Scheduling Coordinator for the project and shall prepare a fully developed construction schedule.

1.3 SUBMITTALS

- A. Contractor's Construction Schedule: Initial schedule, of size required displaying entire schedule for entire construction period.
- B. Daily Construction Reports: Submit at weekly intervals.

1.4 CONSTRUCTION SCHEDULE, GENERAL

- A. Contractor, within fifteen (15) days of receipt of the "Notice to Proceed" from the Architect, shall prepare and submit for the Architect's and Owner's review, a proposed progress schedule that shall set forth a reasonable schedule for completion of the Work within the time provided by the Agreement.
1. Time Frame: Extend schedule from date established for the "Notice to Proceed" to the date of "Substantial Completion."
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, Prime Contractors, and other parties identified by Contractor with a need-to-know schedule responsibility.
- C. Contractor shall carefully review all data on the schedule with Subcontractors.

- D. If, in the opinion of the Architect, the project scheduling, project progress, sequence of operations or other factors require an updating or revision to the schedule, the Contractor shall update and revise the schedule within seven calendar days of the request by the Architect. There will be no limit to the number of times the schedule is revised. Distribute the schedules in the same manner as the original schedule.
- E. In the event a new calendar date for Substantial Completion is authorized during the progress of the work, by the Owner, a new or revised schedule shall be prepared, approved and copies distributed as described above.

1.5 CONSTRUCTION SCHEDULE REQUIREMENTS

- A. Bar Chart Schedule: Submit a comprehensive, fully developed, horizontal, bar chart type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.
 - 1. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1.6 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. Approximately count of personnel at Project site.
 - 3. Tests and inspections.
 - 4. Key activities and material deliveries.
 - 5. Accidents.
 - 6. Meetings and significant decisions.
 - 7. Items accomplished.
 - 8. Unresolved issues/factors contributing to delay.

PART 2 - PRODUCTS - (Not Applicable)

PART 3 - EXECUTION - (Not Applicable)

END OF SECTION 013200

SECTION 013300 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 013200 "Progress Schedules" for submitting Contractor's Construction Schedule.
2. Section 017840 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

- A. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 SUBMITTALS

- A. Submittal Schedule: Within 30 days after the date of receipt of the Notice to Proceed, the Contractor shall submit, as an action submittal, a list of submittals arranged in chronological order by dates required by construction schedule. Include additional time required for review, ordering, fabrication, and delivery when establishing dates.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Format: Arrange the following in a tabular format:
 - a. Specification section number and title.

- b. Description of work covered.
- c. Submittal Type: Product data/shop drawing/samples/etc.
- d. Name of subcontractor.
- e. Projected transmittal date.
- f. Projected Architect approval date.
- g. Projected delivery date.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Processing Time: Allow time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of contract time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittal.
 - 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. Consultant Review: Submittals being issued to the architect's consultants shall be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- C. Identification: Place a permanent label or title block on each submittal for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.

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2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.
 - g. Name of manufacturer.
 - h. Submittal identification number.
 - i. Number and title of appropriate Specification Section.
4. All Prime Contractors shall utilize a 9+ character submittal identification numbering system in the following manner:
 - a. The first six digits are to be the applicable Specification Section Number.
 - b. The next three digits shall be the numbers (001, 002, 003, etc.) to sequentially number each initial separate item submitted. The last character shall be a letter (A-Z) indicating the submission or resubmission version, i.e. "A"= initial submission, "B"= 2nd submission, "C"= 3rd submission, etc. A typical submittal identification number would be as follows:

033000-004-B – (xxxx)

| | |
|--------|---|
| 033000 | – Specification for Concrete |
| 004 | – the fourth submittal under this specification section |
| B | – 2nd submission of that particular shop drawing |
| xxxx | – Brief description of items in submittal |
5. All submittals shall be clearly identified using the submittal identification numbering system. The Contractor, on the individual items to be reviewed and on the transmittal cover sheet under which the submittals are shipped, shall provide the submittal identification number.
 - a. Electronic submittals shall have the submittal identification number indicated on the "Subject" line on submittals sent via email.

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- D. Options: Identify options requiring selection by Architect.
- E. Deviations: Identify deviations from the Contract Documents on Submittals.
- F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- G. 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.
- H. 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.
- I. Color Finish Schedule: A finalized color schedule indicating color selections for all building materials will be provided by the Architect upon completion of all submittals for all products requiring a color selection have been submitted.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
- B. Electronic Submittals: At the Contractors option, submit electronic submittals via email in PDF format.
 - 1. Architect, will electronically return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - a. Electronic reproductions of manufacturers color charts will not be accepted for color selection. Colors will be selected from an original document provided by the manufacturer.
- C. 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 with products to be provided for this project clearly identified.
 - b. Manufacturer's product specifications.
 - c. Color charts (Hard copies only) for all colors, patterns, and textures available for each product.
 - 1) Electronically transmitted color charts will be accepted for record purposes but will not be used for color selection.
 - d. Application of testing agency labels and seals.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale and with the scale clearly indicated. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Schedules.
 - b. Compliance with specified standards.
 - c. Notation of coordination requirements.
 - d. Notation of dimensions established by field measurement.
 - e. Relationship and attachment to adjoining construction clearly indicated.
 - f. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.

SUBMITTAL PROCEDURES

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- a. For Shop Drawings in format larger than 11 inches by 17 inches, provide one hard (printed) copy to the Architect along with the required electronic submittal.
- E. Samples: Submit physical 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. Electronically transmitted images of samples and/or color charts will be accepted for record purposes, but will not be used for color/finish selections.
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.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are made, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 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 two full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used

materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) 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.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
 1. **NO EXCEPTION TAKEN** – This action is assigned when the information provided requires no additional notes or comments on the submittal and the information provided is in general conformance with the Plans and Specifications. The Contractor may release the equipment or material for purchase or fabrication.
 2. **MAKE CORRECTIONS NOTED** – This action is assigned when the information provided requires only minor notes or comments be added or corrections made to the submittal and the information provided is in general conformance with the Plans and Specifications. For clarification, this action may include additional comments from the Architect indicating the extent of changes required.

3. **REJECTED** – This action indicates the information provided does not meet the intent of the design or is not specified on the Drawings and/or Specifications. Product substitutions made in this manner will be rejected. The Contractor shall not release any equipment or material for purchase or fabrication. The Architect will return the contents of the submittal at the Contractors expense. The Contractor shall resubmit the entire contents of the submittal.
4. **REVISE AND RESUBMIT** – This action indicated the information provided is incomplete or notes and comments are extensive enough to require a resubmittal of some or all of the information. This resubmittal is to address all comments, omissions, misrepresentations, and insufficient data that were received by the Architect. The Contractor may, at their option, release the equipment or material for purchase or fabrication and resubmit the information requested for additional action. All notations and comments must be in incorporated into the final product.
5. **SUBMIT SPECIFIED ITEM** – This action assigned indicates that information is missing from the Shop Drawing submittal. The Contractor should not release the equipment or material for purchase or fabrication.

END OF SECTION 013300

SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for temporary services, including utilities, construction and support facilities, security, and protection facilities.
- B. All facilities and utilities specified under this Section shall be furnished, maintained, and paid for until the date of Substantial Completion.
- C. Temporary utilities required include, but are not limited to, the following:
 - 1. Water service and distribution.
 - 2. Construction electric power and light.
- D. Temporary construction and support facilities required include but are not limited to:
 - 1. Temporary storage sheds or units.
 - 2. Staging areas and construction parking.
 - 3. Sanitary facilities.
 - 4. Hoists.
 - 5. Waste disposal services.
 - 6. Construction aids and miscellaneous services and facilities.
 - 7. Temporary fire protection.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the General Contractor's Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost including, but not limited to, Owner's construction forces, testing agencies, and authorities having jurisdiction.

- B. Water Service: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service: Electric power from Owner'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.

1.4 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.

1.5 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site. Maintain all temporary access drives and construction parking at all times.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

- A. Field Office Space: The Owner shall provide an area for field office activities, job meetings, etc. for the Prime Contractors (At project Location).
- B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.
- C. At the Substantial Completion of the project, all temporary facilities shall be removed from the site. General Contractor shall repair the site as necessary to match original conditions.

2.2 MATERIALS

- A. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- B. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

- C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.3 EQUIPMENT

- A. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- B. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- C. Telephone Service: Contractors shall provide cell phone at the project site for use in communications during the Contract.
- D. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
- E. First Aid Supplies: Comply with governing regulations.
- F. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A B C" dry chemical fire extinguishers for locations where critical operations occur such as welding, cutting, etc.
 - 1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

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, modify, and extend 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. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At

Substantial Completion, restore these facilities to condition existing before initial use.

1. Each respective Contractor requiring water shall provide and maintain piping and hoses necessary to carry construction water to locations at which they are required.
- B. Sanitary Facilities: Provide temporary toilets complying with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best service the Project's needs. Coordinate temporary toilet location with the Owner.
1. Provide toilet tissue and similar disposable materials for each facility. Provide covered waste containers for used material.
- C. Temporary Ventilation: Provide ventilation to maintain the indoor temperature of the building as required to prevent accumulation of excess moisture and prevent excess thermal movement in the building.
- D. Electric Power Service: Electrical Contractor shall provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Power shall be extended from existing available and adequate sources within the existing building where work is underway.
- E. Lighting: Electrical Contractor shall provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, and inspections.
- F. Contractors doing field welding on the project must provide a portable generator for electric power. No 208-volt or 480-volt connections to the existing service will be permitted. Only 120-volt convenience outlets and lighting are permitted.

3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate temporary storage sheds, sanitary facilities and other temporary construction and support facilities for easy access and as approved by the Owner and Architect.
- B. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- C. Waste Disposal Facilities: Each Prime Contractor shall provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- D. Lifts and Hoists: Each Prime Contractor shall provide to the extent required all facilities necessary for hoisting materials.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Temporary Partitions: Provide sound insulated and dustproof partitions and closures to completely separate and isolate construction areas from the remainder of the building until Substantial Completion is obtained for that area.
1. Partitions shall be framed with steel studs. The owner occupied side of the partition and closures shall be covered with 5/8-inch drywall. Construction side shall be covered with 1/2-inch plywood. Studs shall be covered polyethylene sheets to retain dust transmission to occupied side. All drywall joints and fasteners shall be filled and smoothed, after which the drywall and doors shall be finished with (2) coats of VOC compliant paint.
 - a. Review contract drawings to determine locations and quantities of temporary partitions and closures.
 2. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 3. Provide walk-off mats at each entrance through temporary partition.
- B. Temporary Fire Protection: Install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Locate fire extinguishers where convenient and effective for their intended purpose.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion unless otherwise indicated.
- D. Termination and Removal: Remove each temporary facility when the need has ended, when 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 the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

3.6 REFUSE REMOVAL

- A. The General Contractor shall provide sufficient dumpster service for the disposal of all construction waste, trash, and rubbish.
 - 1. Each Prime Contractor shall comply with progress cleaning requirements in Section 017300 "Execution" and with requirements of authorities having jurisdiction.

END OF SECTION 015000

SECTION 016000 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
 - 1. Multiple Prime Contracts: Provisions of this Section apply to the construction activities of each Prime Contractor.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for material substitutions.
 - 2. Sections 017700 "Closeout Procedures" for submitting warranties for contract closeout.
 - 3. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.

3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified project.
- B. Basis-Of-Design Product Specifications: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation.
 1. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, physical properties, dimensions, durability, visual characteristics, and other special features for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Bidder.
- D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- E. Special Warranty: Written warranty required or incorporated into the Contract Documents, to extend time limit provided either by manufacturers warranty or to provide more rights for Owner.

1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include the manufacturer's name and proprietary product names for each product.
 1. Coordinate product list with Contractor's Construction Schedule and the Schedule of Submittals.
 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in Contract Documents.
 - c. Proprietary name, model number and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name, address, telephone number and name of contact personnel.

- f. Installer's name, address, telephone number and name of contact personnel.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
3. Initial Submittal: Within 30 days after date of commencement of the Notice to Proceed, submit two copies of initial product list. Include a written explanation for omissions of data, and variations from Contract requirements.
- a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
4. Completed List: Within 60 days after date of commencement of the Notice to Proceed, submit three copies of completed product list. Include a written explanation for omissions of data, and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt completed product list. Architects response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product comparable with products previously selected, even if previously selected products were also options.
- 1. Each Prime Contractor is responsible for providing products and construction methods compatible with products and construction methods of other Contractors.
 - 2. If a dispute arises between Contractors over concurrently selectable, but incompatible products, Architect will determine which products shall be used.
 - 3. The material selected by the Architect shall be provided at no additional cost to the Owner.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products using means and methods that will prevent damage, deterioration and loss, including theft and vandalism. Comply with manufacturers written instructions.
 1. Notify the Owner 48 hours in advance of major deliveries.
 2. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 3. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
 4. Deliver products to Project site in undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
 5. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
 6. Store products to allow for inspection and measurement of quantity or counting of units.
 7. Store materials in a manner that will not endanger Project structure.
 8. Store products subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

9. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
10. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Refer to Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents that are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with all accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Where the products are accompanied by the term "as selected," Architect will make selection.
 4. Descriptive, performance, and reference standard requirements in the specifications establish "salient characteristics of products."

5. Or Equal: Where products are specified by name and accompanied by the term “or approved equal,” comply with provisions in “Comparable Products” Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection are as follows:
1. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
 2. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that comply with requirements.
 3. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 4. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements.
 5. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements.
 6. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product[s]" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
 7. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
 8. Visual Matching Specifications: Where Specifications require “match Architect’s Sample,” provide a product that complies with requirements and matches Architect’s sample. Architect's decision will be final on whether a proposed product matches.

9. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or similar phrase, select a product (and manufacturer) that complies with specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect and Owner will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect and Owner will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COLOR SELECTION

- A. Pre-Selected Colors: Where colors have been specifically identified in the Contract Documents, the products provided by the Contractor shall match the selected color to the satisfaction of the Architect or the product will be rejected as non-conforming materials.
 1. Manufacturers listed in the specification sections are capable of manufacturing the product specified but may not manufacture the specific selected color identified in the Contract Documents as part of their running line.
- B. If additional up-charges are associated with providing the colors identified in the Contract Documents, the Contractor shall be responsible for all such costs and no additional cost to the Owner above the Contract Sum will be considered.
- C. Colors Selected During Construction: Products will be selected by the Architect from the standard colors of any of the listed or approved manufacturers, unless a specific color or color price range has been identified prior to bidding.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 – EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
1. Construction layout.
 2. Installation of the Work.
 3. Progress cleaning.
 4. Starting and adjusting.
 5. Protection of installed construction.
- B. Related Requirements:
1. Section 017300 "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
 2. Section 017700 "Closeout Procedures" for final cleaning requirements.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS (Not Used)

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 and floors 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. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- C. 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 Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner not less than 30 days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.
 3. All utility interruptions shall be scheduled for weekends or holidays.
- 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 Section 013100 "Project Management and Coordination."

3.3 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- 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.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- 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.

EXECUTION

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1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. 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.

3.4 PROGRESS CLEANING

- A. Refuse Removal, General: General Contractor shall provide sufficient dumpster service for the disposal of all waste and rubbish. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. Construction Waste: Each Prime Contractor shall be responsible to collect and to deposit his construction waste, defined as demolition debris, rubble, and scrap resulting from construction activities on a weekly basis in the dumpsters provided by the General Contractor.
- C. Trash: Each Prime Contractor shall be responsible for collecting and depositing his trash, defined as food waste, paper, and other non-construction waste, in the trash dumpster daily (also part of daily cleanup).
- D. As part of its daily cleanup, each Prime Contractor shall remove its construction waste and trash from pipe chases, plenums, attics, crawlspaces, and other enclosed or remote spaces, on a daily basis and prior to enclosing those spaces.
- E. General Contractor will be responsible for the removal of all construction waste and trash from the jobsite, and the overall cleanliness of the entire jobsite.
- F. General Contractor shall broom clean the entire project at least once a week.

1. Broom and vacuum clean interior areas prior to starting surface finishing, and continue through to Substantial Completion or acceptance to Owner.
- G. Each Prime Contractor shall be responsible for providing trash collection barrels, or durable containers, within the building construction areas. Contractors shall be responsible for emptying the barrels at the end of each day.
- H. Prime Contractors shall collect and remove their own liquid waste from the jobsite. Hazardous materials shall not be placed in the dumpster, but shall be removed from the site by the Prime Contractor responsible for the material. All costs associated with a violation will be the responsibility of the Prime Contractor.
- I. Prime Contractors shall clean construction areas of all trash and debris to eliminate the potential infestation of rodents. All discarded food and trash shall not be allowed to accumulate around the construction site.
- J. 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.
- K. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- L. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- M. 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.
- N. 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.
- O. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.5 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 safeties. Replace damaged and malfunctioning controls and equipment.

3.6 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 manufacturers written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017330 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes procedural requirements for cutting and patching.
- B. Related Requirements:
 - 1. Section 024119 "Selective Demolition" for demolition of selected portions of the building.
 - 2. Divisions 2 through 31 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent Work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent Work whether indicated on Demolition Drawings or not.

1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades.
 - 1. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 SUBMITTALS

- A. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.

1.6 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
- D. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.3 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.

- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as 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 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.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

END OF SECTION 017330

SECTION 017700 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section specifies 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.
 6. Closeout requirements for specific construction activities are included in the appropriate Specifications for all Prime Construction contracts.

1.3 SUBSTANTIAL COMPLETION PROCEDURES

- A. Submittals Prior to Substantial Completion:
1. Application for Payment: If the Application for Payment coincides with, or first follows, the date Substantial Completion, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documents for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, using a multiple of one and one-half (1-1/2) times the cost of incomplete construction, and reasons the Work is not complete.
- B. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for certification of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.

2. Make final changeover of permanent locks and deliver keys to Owner. Advise the Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Architect and Owner in conducting final inspection and walkthrough with local building code officials
 8. Terminate and remove temporary facilities from Project site, along with 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.
 11. Submit testing, adjusting, and balancing records.
- C. Punch List Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, which 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.

1.4 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for certification of final completion, complete the following:
1. Submit final Application for Payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

- a. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion Punch List inspection of items to be completed or corrected, endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit AIA Document G706, Contractors Affidavit of Payment of Debts and Claims.
6. Submit AIA Document G706A, Contractors Affidavit of Release of Liens.
7. Submit AIA Document G707, Consent of Surety to final payment.
8. Prior to receiving final payment, the Contractor shall submit the marked-up As-Built Contract Drawings in digital PDF format. The PDF image size shall match the original drawing size (e.g. 30" x 42").
9. Submit final meter reading for utilities, a measured record of stored fuel and similar data as of the date of Substantial Completion, or when the Owner took possession of responsibility for the corresponding elements of the work.

1.5 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 Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 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 paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
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.

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.

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.
 1. Each Prime Contractor is responsible for final cleaning of the Work included in their contract.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions
- C. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion for entire Project or for a designated phase of the Project.
 1. Remove tools, construction equipment, machinery and surplus material from Project site.
 2. Clean exposed hard-surfaced finishes to a dirt- and dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original and intended condition.

3. Remove debris and surface dust from limited access spaces, including plenums and similar spaces.
 4. Clean all vinyl composition tile floors.
 - a. Owner's personnel will do waxing and polishing of vinyl composition tile floors.
 5. Clean transparent materials, including glass in doors and windows. Remove glazing compounds and other noticeable vision-obscuring materials. Clean all frames retaining glass.
 6. Remove labels that are not permanent.
 7. Remove excess lubrication, paint and mortar droppings and other foreign substances.
 8. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 9. Clean light fixtures to function with full efficiency.
 10. Leave the Project clean and ready for occupancy. Remove all debris.
- D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of in a lawful manner.

END OF SECTION 017700

SECTION 017840 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
1. Marked-up copies of Contract Drawings.
 2. Field records for variable and concealed conditions.
- B. Multiple Prime Contracts: Each Prime Contractor is responsible for obtaining, maintaining, and recording Project Record Document information for its own part of the Work.
- C. Related Requirements:
1. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract including Substantial Completion and Final Completion procedures warranties, and final cleaning.
 2. Divisions 02 thru 33 Sections for specific requirements for Project Record Documents of products in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Contractor shall scan and submit one marked-up .pdf set of record drawings electronically to the Architect.
1. Submit each drawing whether or not changes and additional information were recorded.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record As-Built Prints: The General Contractor shall maintain one set of marked-up paper copies of the Contract Drawings to be designated for as-built

record drawings. Each Prime Contractor will be required to update the as-built drawings on a weekly basis.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record and check markup before enclosing concealed installations.
2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Revisions to routing of piping and conduits.
 - d. Revisions to electrical circuitry.
 - e. Actual equipment locations.
 - f. Duct size and routing.
 - g. Locations of concealed internal utilities.
 - h. Changes made by Change Order or Construction Change directive.
 - i. Details not in original Contract Drawings.
 - j. Field records for variable and concealed conditions.
 - k. References related to Shop Drawings and Submissions.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

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.
 - 1. 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.
 - 2. Provide access to project record documents for Architect's and Owner's reference during normal working hours.

END OF SECTION 017840

SECTION 024120 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.

B. Related Requirements:

1. Section 011000 "Summary of Work" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017329 "Cutting and Patching" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management." Review methods and procedures related to selective demolition including, but not limited to, the following:
1. Inspect and discuss condition of construction to be selectively demolished.
 2. Review structural load limitations of existing structure.
 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Locations of proposed dust- and noise control temporary partitions and means of egress.
 5. Coordination of Owner's continuing occupancy of portions of existing building.
- B. Certified statement from existing roof system manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.6 HAZARDOUS MATERIALS

- A. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. Hazardous materials will be removed by the Owner before start of the Work.
 2. If suspected hazardous materials are encountered, do not disturb; immediately notify the Architect and Owner. Owner will remove hazardous materials under a separate contract.

1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
1. Comply with requirements specified in Section 011100 "Summary of Work."

- B. Owner will maintain conditions existing at time of inspection for bidding purpose as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTIES

- A. Existing Roofing Warranty: Remove, replace, patch, and repair materials and surfaces cut or damaged during existing building alteration activities by methods and with materials so as not to void existing roofing system warranty.
 - 1. Notify warrantor of existing roofing system before proceeding with the Work.
 - 2. Notify warrantor on completion of any roof repair work and obtain documentation verifying that the existing roofing system has been inspected and warranty remains in effect.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.
- C. Sustainable Design Requirements for Building Reuse:
 - 1. Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
 - 2. Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.

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 the Architect.
- D. Engage a professional engineer to perform an engineering survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of pre-construction photographs.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove, refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Existing Service/System Requirements: 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. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove, HVAC systems, plumbing, and fire-suppression systems, equipment, and components indicated on Drawings to be removed.

- a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
- b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
- c. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 1. Strengthen or add new supports when required during progress of selective demolition.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. 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.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

- D. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
 - 1. Cut and remove portion of existing roof as required to install new curbs, mechanical equipment and roof penetrations.
 - a. The installation including flashing, patching and auxiliary materials to tie into existing roofing to maintain watertightness of transition and to not void warranty for existing roof system.
 - 2. Refer to Contract Drawings for additional information.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolished waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

3.8 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 024120

SECTION 033053 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 UNIT PRICES

- A. Unit prices for additional concrete slab-on-grade work is included in Section 004116 “General Construction Bid Form – Proposal.”
- B. Quality allowance for additional concrete slab-on-grade work is included in Section 004116 “General Construction Bid Form – Proposal.”

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splicers and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.5 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. Comply with the following sections of ACI 301 unless modified by requirements in the Contract Documents:
 - 1. "General Requirements."
 - 2. "Formwork and Formwork Accessories."
 - 3. "Reinforcement and Reinforcement Supports."
 - 4. "Concrete Mixtures."
 - 5. "Handling, Placing, and Constructing."
- B. Comply with ACI 117.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

2.3 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150, Type I.
- C. Normal-Weight Aggregate: ASTM C 33, 1-1/2-inch nominal maximum aggregate size.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A.
 - 2. Water-Reducing Accelerator Admixture: ASTM C 494, Type E, and containing not more than 0.1 percent chloride ions.
- F. Water: ASTM C 94.

2.4 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.5 CONCRETE MIXTURES

- A. Comply with ACI 301.
- B. Normal Weight Concrete:
 - 1. Compressive Strength:
 - a. Exterior Concrete: 4,000 psi minimum at 28-days.
 - b. Chainlink Fence Footings: 3,750 psi at 28-days.
 - 2. Cement: Type I cement.
 - 3. Air Content: 3% maximum (natural).
 - 4. Max W/C = 0.45”.
 - 5. Slump: 3-1/2 inches prior to adding HRWR admixture.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 STEEL REINFORCEMENT INSTALLATION

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

3.5 CONCRETE PLACEMENT

- A. Comply with ACI 301 for placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- C. Consolidate concrete with mechanical vibrating equipment according to ACI 301.

3.6 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding 1/2 inch.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.
 - 1. Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete.

- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.7 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturers written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. Testing Frequency: Obtain one composite sample of five standard cylinders for each day's pour exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof; two specimens tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

END OF SECTION 033053

SECTION 035416 - CEMENT-BASED UNDERLAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

- B. Related Requirements:

- 1. Division 09 Sections for patching and leveling compounds applied with floor coverings.

1.3 UNIT PRICES AND ALLOWANCES

- A. Unit Price information for hydraulic cement underlayment is included in the “General Construction Bid Form – Proposal.”

- B. Material allowance information for hydraulic cement underlayment is included in the “General Construction Bid Form – Proposal.”

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 “Project Management and Coordination.”

1.5 SUBMITTALS

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

- B. Manufacturer Certificates: Signed by manufacturers of both underlayment and floor covering system certifying that products are compatible.

- C. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.
- B. Product Compatibility: Manufacturers of both underlayment and floor covering system certify in writing that products are compatible.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place hydraulic cement underlayment only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

PART 2 - PRODUCTS

2.1 HYDRAULIC CEMENT UNDERLAYMENTS

- A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling hydraulic cement product that can be applied in minimum uniform thicknesses of 1/4-inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ARDEX Engineered Cements; ARDEX K-15 Premium Self-Leveling Underlayment.
 - 2. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 - 3. Compressive Strength: Not less than 4,100 psi at 28 days when tested according to ASTM C 109.
 - 4. Flexural Strength: 1,000 psi, 28-day test in accordance with ASTM C 348.
 - 5. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; as recommended by underlayment manufacturer.
 - 1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

- C. Water: Potable and at a temperature of not more than 70 deg F.
- D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare and clean substrate according to manufacturers written instructions.
 - 1. Treat nonmoving substrate cracks according to manufacturers written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 - 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 - 1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
- C. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.
 - 1. If necessary, substrate preparation must be by mechanical means such as shot blasting. Do not use acid etching, sweeping compounds, solvents or adhesive removers.
- D. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 INSTALATION

- A. Mix and install underlayment components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment installation and for time period after installation recommended in writing by manufacturer.
 - 2. Coordinate installation of components to provide optimum adhesion to substrate and between coats.
 - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
 - 4. Add aggregate as recommended by manufacturer to areas where underlayment will be over a 1-1/2 inch thickness.
- B. Apply primer over prepared substrate according to manufacturer's written instructions and at manufacturer's recommended spreading rates.
- C. Install underlayment to produce uniform, level surface.
 - 1. Install a final layer without aggregate to product surface.
 - 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during installation and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 035416

SECTION 042000 – UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Types of masonry work required include, but is not limited to, the following:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Reinforcing steel.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
- B. Products installed, but not furnished, under this Section:
 - 1. Steel lintels in unit masonry construction.
 - 2. Hollow-metal frames in unit masonry openings.
- C. Related Requirements:
 - 1. Section 079000 “Joint Sealants” for sealing control and expansion joints in unit masonry.

1.3 UNIT PRICES

- A. Unit Prices for additional concrete masonry unit partition work is included in Section 004116 “General Construction Bid Form – Proposal.”
- B. Quantity allowance information for additional concrete masonry unit partition work is included in Section 004116 “General Construction Bid Form – Proposal.”

1.4 SUBMITTALS

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

1. Manufacturer's product data for each type of masonry unit, accessory, and other manufactured products specified.
- B. Material Certificates: For each type and size of the following:
1. Masonry units. Include data on material properties.
 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars and joint reinforcement.
 6. Anchors, ties, and metal accessories.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- 1.5 QUALITY ASSURANCE
- A. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6 "Specifications for Masonry Structures", except as otherwise indicated.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- 1.7 FIELD CONDITIONS
- A. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

UNIT MASONRY ASSEMBLIES

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2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops indicated net-area compressive strengths (fm) at 28 days.
- B. Determine net-area compressive strength (fm) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1 ASCE 6/TMS 602.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified requirements, in the Contract Documents.

2.4 CONCRETE MASONRY UNITS (CMU)

- A. Shapes: Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding, bond beams, etc. and other special conditions.
 - 1. Provide bullnose units for outside corners and units at doors, unless otherwise indicated.
- B. Concrete Block: ASTM C 90 and as follows:
 - 1. Provide units complying with characteristics indicated below for Grade, Type, face size, exposed face and, under each form included, for weight classification.
 - 2. Provide unit masonry that develops the following installed compressive strengths (f^1_m):
 - a. For concrete unit masonry as follows:
 $f^1_m = 1500$ psi
as indicated
 - 3. Weight Classification: Normal weight.

4. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thicknesses indicated.
5. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold weather construction. Provide natural color or white cement as required to produce required mortar color. Obtain from one manufacturer to insure color uniformity.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Aggregates for Mortar: ASTM C 144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- E. Aggregate for Grout: ASTM C 404.
- F. Water: Clean, potable.

2.6 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Reinforcing Bar Positioners: Wire units, designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - b. Hohmann and Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.

2.7 MASONRY JOINT REINFORCEMENT

- A. General: ASTM A 951 and as follows:
 1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.

2. Wire Size for Side Rods: 0.148-inch diameter.
 3. Wire Size for Cross Rods: 0.148-inch diameter.
 4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
 5. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
 - a. AA Wire Products Co.
 - b. Hohmann & Barnard, Inc.
 - c. Heckmann Building Products, Inc.
- B. Masonry-Joint Reinforcement for Single-Wythe Masonry: Truss design with single pair of side rods.

2.8 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82, with ASTM A 153, Class B-2 coating.
- C. Galvanized Steel Sheet Anchors: As follows:
 1. Galvanized Steel Sheet: ASTM A 366 (commercial quality) cold-rolled carbon steel sheet, hot-dip galvanized after fabrication to comply with ASTM A 525, Class B2 (for unit lengths over 15 inches), for sheet metal ties and anchors.
 2. Thickness of Steel Sheet Galvanized After Fabrication: Uncoated corrugated steel sheet, 0.0598-inch-thick, hot-dip galvanized after fabrication.
 - a. Size: 1-1/4 inch wide. Extend to within 1 inch of masonry units.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

- B. Premolded Control Joint Strips: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
 - 1. Styrene-butadiene rubber compound complying with ASTM D 2000, Designation M2AA-805.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds or other admixtures, unless otherwise indicated.
- B. Mixing: Combine and thoroughly mix cementitious, water and aggregates in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.
- C. Preblended, Dry Mortar Mix: Comply with ASTM C 1714, furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to project site.
- D. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For interior non-load-bearing partitions, use Type N.
- E. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of reinforced and nonreinforced unit masonry. Use grout of consistency with materials proportioned to provide a compressive strength of 3000 pounds per square inch in 28 days at time of placement, which will completely fill all spaces intended to receive grout.
 - 1. Use fine grout in grout spaces less than 2 inches in horizontal direction, unless otherwise indicated.
 - 2. Use coarse grout in grout spaces 2 inches or more in least horizontal dimension, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify that reinforcing dowels are properly placed.

- B. Before installation, examine rough-in and built-in construction for piping systems for verify actual locations of piping connections.

3.2 MASONRY INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls, and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- D. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate locations of openings, movement-type joints, returns and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and other locations.
- B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.
- C. Bond Pattern: Lay exposed face brick and concrete masonry units in a running bond consisting of all stretchers with vertical joints centered on the stretcher in the preceding course. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core. All cores where reinforcing bars occur shall be grouted solid.
- E. Fill cores in hollow CMU's with grout 24-inches under bearing plates, beams, lintels, and similar items, unless otherwise indicated.
- F. Build non-load-bearing interior partitions full height as indicated on Drawings.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay solid brick-size masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints. Do not furrow bed joints. Do not re-temper mortar.
- B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells. Fill all cells and cavities receiving embedded items with concrete or grout.
- C. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8-inch joints.
- D. Tool exposed joints of all units, concaved using a jointer larger than joint thickness, unless otherwise indicated.
- E. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

3.5 STRUCTURAL BONDING OF MASONRY

- A. Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bond tie between wythes. Install at not more than 16 inches o.c. vertically.
- B. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.
 - 1. For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units, in addition to masonry bonding.
- C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:
 - 1. Interlock perpendicular walls in an overlapping masonry pattern.
 - 2. Provide continuity with horizontal joint reinforcement using prefabricated "T" units.

3.6 HORIZONTAL JOINT REINFORCEMENT

- A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8-inch exterior side of walls, 1/2-inch elsewhere. Lap reinforcing a minimum of 6 inches.

- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.
- D. Reinforce the following walls with continuous horizontal joint reinforcement:
 - 1. Single-wythe walls.
 - 2. Hollow concrete masonry walls.
- E. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- F. Space continuous horizontal reinforcement as follows:
 - 1. For single-wythe walls, space reinforcement at 16-inches o.c. vertically, unless otherwise indicated.
- G. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in two horizontal joints approximately 8 inches apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints.
 - 1. In addition to wall reinforcement, provide additional reinforcement at openings as required to comply with the above.

3.7 EXPANSION AND CONTROL JOINTS

- A. General: Provide vertical and horizontal, control and expansion joints in masonry where indicated on the drawings, and as specified herein.
- B. Interior Concrete Masonry Unit Walls:
 - 1. Provide 3/8-inch wide control joints as detailed on the drawings and not more than 25 feet on center horizontally and as follows:
 - 2. At a distance of not greater than 12 feet from bonded intersections or corners with the preferable location one header or stretcher unit from the corner.
 - 3. At one or both sides of all door and window openings unless other crack control measures are used, such as bond beams or joint reinforcement. Joints above doors and windows shall be offset to the ends of lintels.
 - a. Openings less than 6 feet wide require a control joint along one side only; openings of more than 6 feet shall have joints along both sides.

- C. Form control joints in concrete masonry as follows:
1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.
- D. Review all control joint and expansion joint locations and details with Architect in advance of proceeding with the work.

3.8 LINTELS

- A. Install all loose steel angle and beam lintels where indicated.
- B. Provide bearing of 8-inches at each jamb, unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY INSTALLATION

- A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.10 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Owner shall engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Owner shall follow Level 2 Special Inspection Procedures as listed in Table 1704.5.3 in the International Building Code.
- C. Test results will be reported in writing to the Architect.

3.11 REPAIR, POINTING, AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
 - 2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
 - 3. Protection: Provide final protection and maintain conditions in a manner acceptable to Installer, which ensures unit masonry work being without damage and deterioration at time of substantial completion.

3.12 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Loose steel lintels.
2. Miscellaneous steel masonry partition wall bracing and clip angles.
3. Supplemental steel for new roof openings for new HVAC equipment and roof penetrations as indicated. Reference HVAC Drawings for additional information.
4. Reinforcement of existing steel roof trusses.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Galvanized steel pipe bollards.
7. Steel diamond plate.

B. Related Requirements:

1. Section 042000 “Unit Masonry Assemblies” for installation of loose steel lintels and bearing plates.

C. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.

1.3 UNIT PRICES

- A. Unit prices for miscellaneous metal fabrications are included in Section 004116 “General Construction Bid Form – Proposal.”
- B. Quality allowances for miscellaneous metal fabrications are included in Section 004116 “General Construction Bid Form – Proposal.”

1.4 COORDINATION

- A. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.5 SUBMITTALS

- A. Product Data: For the following:
1. Steel diamond plate material.
 2. Bollard covers for steel pipe bollards.
- B. Shop Drawings: Show fabrication and installation details.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Welding Certificates: Certificates for welding procedures and personnel.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1 “Structural Welding Code – Steel”.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For material fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Angles, Plates, Shapes, and Bars: ASTM A 36.
- C. Steel Pipe: ASTM A 53, Standard Weight (Schedule 80), galvanized where indicated.
- D. Steel Diamond Plate: ASTM A 786, hot rolled, commercial grade, 13 gage.

METAL FABRICATIONS

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2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-headed bolts, ASTM A 307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High Strength Bolts: ASTM A 325.
- D. Lag Bolts: Square head type, FS FF-B-561.
- E. Machine Screws: Cadmium plated steel, FS FF-S-92.
- F. Plain Washers: Round, carbon steel, FS FF-W-92.
- G. Drilled-In Expansion Anchors: Expansion anchors complying with FS FF-S-325, Group VIII (anchors, expansion, [non-drilling]), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.
- H. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

2.3 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified alkyd primer complying with MPI #79 and compatible with topcoat.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint-20 and compatible with paints specified to be used over it.

2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form exposed work with accurate angles and surfaces and straight edges.
- D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
- E. Cut, reinforce, drill and tap miscellaneous fabrications where to receive finish hardware, screws, and similar items.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure miscellaneous steel fabrications rigidly in place and to support indicated loads.

2.5 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize and prime loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports as needed to complete the work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
1. Furnish inserts if units are installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

2.7 PIPE BOLLARDS

- A. Galvanized Steel Pipe Bollards: Fabricate metal pipe bollards from Schedule 80 steel pipe. Cap bollards as detailed on the Drawings.

1. Bollard Covers: Manufacturers standard thermoplastic polyethylene with ultra-violet and anti-static additives. Provide dome top design with tape grooves. Refer to Drawing A102 for additional information.

2.8 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.
 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 1. Exteriors (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors. At metal studs provide adequate sized steel plates welded to studs to receive fastenings.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for overhead grilles securely to, and rigidly brace from, building structure.

3.4 INSTALLATION OF PIPE BOLLARDS

- A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with non-shrink, non-metallic grout, mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8-inch toward bollard.
 - 1. Fill metal-capped bollard solidly with concrete and provide rounded concrete cap as detailed.

3.5 ADJUSTING AND CLEANING

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 061000 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Framing with dimension lumber.
 2. Wood blocking and nailers.
 3. Wood furring and grounds.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers between and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWA Standard U1; Use Category UC2.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
 2. Wood floor plates that are installed over concrete slabs-on-grade.
- E. 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. Wood-Preservative-Treated Materials:
 - a. Hoover Treated Wood Products, Inc.

- b. Koppers Performance Chemicals, Inc.
- c. Lonza Wood Protection.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Furring.
 - 4. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:
 - 1. Hem-fir (north); NLGA.
 - 2. Mixed southern pine; SPIB.
 - 3. Spruce-pine-fir; NLGA.
 - 4. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine, No. 2 grade; SPIB.
 - 2. Hem-fir or hem-fir (north), Construction or 2 Common grade; NLGA, WCLIB, or WWPA.
 - 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.4 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this Article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153.

- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Material: Provide carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
- E. Wood Screws: ASME B18.6.1.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
 - 2. Coordinate and install all necessary blocking and framing required for the installation of the television mounting bracket assemblies.
- C. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber and plywood.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, “Fastening Schedule,” in ICC’s International Building Code (IBC).
- F. Use common nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- G. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

END OF SECTION 061000

SECTION 079200 – JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Nonstaining silicone joint sealants.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Sample Warranties: For special warranties.

1.4 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40° F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.5 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- B. Colors: Provide custom color of exposed joint sealer indicated or, if not otherwise indicated, as selected by Architect to match the various materials as hereinafter specified.

2.2 LATEX JOINT SEALANTS

- A. Acrylic-Latex Sealant: Acrylic latex or siliconized acrylic latex, non-sag, mildew-resistant, paintable, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik, Inc.; Chem-Calk 600.
 - b. Pecora Corporation; AC-20.
 - c. Tremco Incorporated; Tremflex 834.
 - d. Sherwin Williams; 950A Siliconized Acrylic Latex Caulk.

2.3 SEALANT COLORS

- A. All sealant colors shall be custom, non-standard colors as hereinafter listed. At locations not listed, the color of the sealant will be selected by the Architect from custom, non-standard colors.

2.4 JOINT SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of flexible, non-gassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 1. Either open cell polyurethane foam or closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrate.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
 - 1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers; oil; grease; waterproofing; water repellents; water; surface dirt and frost.
 - 2. Clean concrete, masonry, and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. At locations where existing joint sealer and backing is removed the joint shall be cleaned and prepared to receive new joint filler and backing. Provide primer, bond breaker tape and foam joint fillers as required for the installation.
- B. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer or as indicated by preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturers' written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.
- F. Install sealants by proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in sub-paragraphs below to form smooth, uniform beads of configuration indicated;

to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
4. Provide recessed joint configuration per Figure 8C in ASTM C 1193, of recess depth and at locations indicated.

3.3 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

3.4 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces.
 1. Joint Sealant: Acrylic-latex sealant.
 2. Joint Locations:
 - a. Perimeter joints of exterior wall openings.
 - b. Vertical joints on exposed surfaces of interior masonry.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors, windows, vision panels, fire extinguisher cabinets, etc.
 - d. Joint between gypsum board and concrete masonry units.
 - e. Other joints as indicated.
 3. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081100 – STANDARD STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.
3. Glazing for hollow metal frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

3. Locations of reinforcement and preparations for hardware.
 4. Details of each different wall opening condition.
 5. Details of moldings, removable stops, and glazing.
- C. Label Construction Certification: For door assemblies required to be fire-rated and exceeding limitations of labeled assemblies, submit manufacturer's certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to requirements for labeled construction.
- D. Product Schedule: Provide a schedule of hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.
- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with ANSI/SDI A 250.8, unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amweld Building Products, LLC.
 2. Ceco Door; ASSA ABLOY.

3. Curries Company; ASSA ABLOY.
4. Pioneer Industries.
5. Republic Doors and Frames.
6. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Assemblies complying with NFPA 80 are identical to door and frame assemblies whose fire resistance characteristics have been determined per NFPA 252 and which are labeled and listed by UL, Warnock Hersey, or other qualified testing agency acceptable to authorities having jurisdiction.
1. Doors and frames shall carry a 20-minute fire rating where indicated.

2.3 STEEL DOORS

- A. General: Seamless, hollow construction standard steel doors for interior and exterior locations. Provide doors of sizes, thicknesses, and design indicated.
- B. Exterior and Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level.
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

2.4 HOLLOW METAL FRAMES

- A. General: Welded unit type steel frames for doors, sidelights, borrowed lites, mullions, and other interior and exterior openings. Provide steel frames for doors, transoms, sidelights, borrowed lites, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Materials:
1. Frames for Interior Openings: Fabricated from 0.053-inch-thick cold-rolled steel sheet.
 2. Frames for Exterior Openings: Fabricated from 0.067-inch-thick cold-rolled steel sheet.
- C. Door Silencers: Except on weatherstripped frames, drill stops to receive (3) silencers on strike jambs of single-door frames and (2) silencers on heads of double-door frames. Provide rubber tipped silencers for all frames.

- D. Plaster Guards: Provide minimum 26-gage steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
- E. Terminated Stops (Sanitary Stops): Interior frames shall have door stops terminated 4 inches above the finish floor with a 45 degree angle cut, and close open end of stop closed with steel sheet closure. Cover opening in extension of frame with welded steel filler plate, with welds ground smooth and flush with the frame.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated straps not less than 2 inches wide by 10 inches long.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel, Type B; suitable for exposed applications.
- B. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, or drawing quality, ASTM A 642, hot dipped galvanized in accordance with ASTM A 525, with A60 or G60 coating designation, mill phosphatized.
- C. Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.
- D. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A 153, Class C or D as applicable.
- E. Glazing: Comply with requirements in Section 088000 "Glass and Glazing."

2.7 GLASS PRODUCTS

- A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 2. Thickness: 1-4-inch
 3. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- B. Insulating Glass: Factory assembled units consisting of sealed lites of tempered glass separated by manufacturer's standard spacer material complying with ASTM E 2190.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
 3. Insulating Glass Units: Clear tempered insulating glass units.
 - a. Overall Unit Thickness: 1 inch.
 - b. Outdoor Lite: 1/4-inch tempered clear glass.
 - c. Interspace: 1/2-inch air filled space.
 - d. Interior Lite: 1/4 tempered clear glass.

2.8 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site. Comply with ANSI A250.8 requirements.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
 2. Provide welded frames with temporary spreader bars.
 3. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb.

- C. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from galvanized steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch thick metallic-coated steel channels with channel webs placed even with top and bottom edges.
- D. Thermal-Rated Doors: At exterior locations and elsewhere where shown or scheduled, provide doors fabricated as thermal insulating doors tested in accordance with ASTM C 1363.
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with U factor of 0.41 Btu/(hr x sq ft x deg F.) or better.
- E. Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:
 - 1. Cold-rolled steel sheet.
- F. Core Construction: Manufacturer's standard core construction that produces a door complying with ANSI standards.
- G. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- H. Clearances for Non-Fire-Rated Doors: Not more than 1/8-inch at jambs and heads, except not more than 1/4-inch between pairs of doors. Not more than 3/4-inch at bottom.
- I. Clearances for Fire-Rated Doors: As required by NFPA 80.
- J. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- K. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
 - 3. Hinge reinforcements shall be a minimum 7 gauge (3/16-inch) thick with additional back-up reinforcement.
- L. Glazing Stops: Minimum 18 gage cold-rolled steel.
 - 1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, and other panels in doors.

2. Provide screw applied removable glazing beads on inside of glass, and other panels in doors.
3. Applied stops shall be installed on the room side of frames or as directed by the Architect.

2.9 LOUVERS

- A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades formed of 0.020-inch thick, cold-rolled steel sheet set into 0.032-inch thick steel frame.
 1. Sightproof Louver: Stationary Louvers constructed with inverted-V or inverted-Y blades.
- B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and secure side of interior doors and frames.

2.10 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A 250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

- B. Hollow Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profiles indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.
 - 2. Floor Anchors: Secure with post-installed expansion anchors.
 - 3. Fire-Rated Openings: Install frames according to NFPA 80.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified in SDI A250.8. Shim as necessary.
 - 1. Fire Rated Doors: Install doors with clearances according to NFPA 80.

3.4 GLASS INSTALLATION

- A. Comply with combined written instructions of manufacturers of glass, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

- C. Secure glass with glazing stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

- D. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.5 ADJUSTING AND CLEAN

- A. Prime Coat Touch-up: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touch-up of compatible air-drying rust-inhibitive primer.
- B. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- C. Remove grout and other bonding material from hollow-metal work immediately after installation.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081100

SECTION 083323 – OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Insulated coiling service doors.

B. Related Requirements:

1. Division 26 Sections for electrical service and connections for powered operators and accessories.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Show locations of controls, and other accessories. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors available for units with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard size:

1. Curtain slats.

E. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.

2.3 SERVICE DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
1. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
- a. CornellCookson, LLC.
- b. Overhead Door Corporation.
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Curtain R-Value: 7.7 deg F x h x sq. ft./Btu.
- D. Door Curtain Material: Galvanized steel.
- E. Door Curtain Slats: Flat profile slats of 3-inch center-to-center height.
1. Insulated-Slat Interior Facing: Galvanized steel.
2. Gasket Seal: Manufacturer's standard continuous gaskets between slats.

- F. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from hot-dip galvanized steel and finished to match door.
- G. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- H. Hood: Match curtain material and finish.
 - 1. Shape: Round.
 - 2. Mounting: Face of wall.
- I. Electric Door Operator:
 - 1. Usage Classification: Light duty, up to 25 cycles per day.
 - 2. Operator Location: Front of hood.
 - 3. Motor Exposure: Interior.
 - 4. Motor Electrical Characteristics:
 - a. Horsepower: 1/2 hp.
 - b. Voltage: 115V, single phase, 60 Hz.
 - 5. Emergency Manual Operation: Chain type.
 - 6. Obstruction-Detection Device: Electric sensor edge on bottom bar.
 - a. Sensor Edge Bulb Color: Black.
 - 7. Control Station(s): Interior mounted.
- J. Curtain Accessories: Equip door with weatherseals and astragal.
- K. Door Finish:
 - 1. Powder-Coated Finish: Color as selected by Architect from 180 standard RAL colors.
 - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 MATERIALS, GENERAL

- 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.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653, with G90 zinc coating; nominal sheet thickness (coated) of 22 gage; and as required.
 2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
 3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 22 gauge.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment.
1. Provide removable stops on guides to prevent over-travel of curtain, and a continuous bar for holding wind locks.

2.6 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that project beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653.

2.7 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

2.8 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Door Operator Location(s): Operator location indicated for each door.
 - 1. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
- C. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
 - 1. Electrical Characteristics: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction

from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.

2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- D. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- E. Obstruction Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
1. Electric Sensor Edge: Automatic safety sensor edge, located within weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturers standard take-up reel.
- F. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- H. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- B. Powder-Coat Finish: Manufacturer's factory applied baked-on polyester powder coating that includes a zirconium pre-treatment. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather-resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 087100 - DOOR HARDWARE

PART 1 – GENERAL

1.1 STIPULATIONS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.2 SUMMARY

- A. Furnish and install the hardware and accessories as required for a complete installation
- B. The hardware specified herein is intended to cover all necessary material required to fully complete the hardware requirements of the building except those items of hardware that are specifically covered under another section of these specifications.
- C. Hardware for locations not specifically mentioned herein shall be furnished in ample size, weight and quality and of similar design to the hardware specified for similar conditions.
- D. Cooperate with the other trades and separate contractors so as to insure the proper coordination and incorporation of work under this section with or into the work of others.
- E. Related sections include the following:
 - 1. Division 8 Section “Standard Steel Doors and Frames” for coordination of blocking and hardware installation.
 - 2. Division 10 Section “Metal Lockers” for key lock requirements not specified herein.
 - 3. Division 16 Section for coordination of electrified strikes and alarm systems

1.3 QUALITY ASSURANCE

- A. Codes and Regulation: Comply with applicable requirements of governing authorities having jurisdiction.
- B. Standards: Manufacturers and model numbers listed are to establish a standard of type and quality.
- C. Fire rated Openings: Provide hardware for fire-rated openings in compliance with National Fire Protection Association (NFPA) standard No.80. Provide only hardware which has been tested and listed by Underwriters Laboratories for types and sizes of doors required and complies with requirements of door and door frame labels. Where panic devices are required on fire rated doors provide UL label on exit device indicating “fire exit hardware”. Latching hardware, door closers, ball

bearing hinges, and seals are required whether or not listed in the hardware schedule.

- D. Qualifications: Hardware supplier must be regularly engaged in contracting hardware work, be staffed to expedite work and must have in his employ a person to periodically inspect and direct setting, applying and adjusting of all hardware. Hardware consultant shall be available to Contractor, Architect and Owner.
- E. Through-bolting: All doors shall be internally reinforced to eliminate the need for through-bolting. Coordinate with the door suppliers. Hardware supplier shall remove through bolts prior to shipping hardware to site. Hardware supplier shall note on Finish hardware schedule that through bolting is not required.

1.4 TEST, INSPECTIONS

- A. Finish hardware supplier shall provide services of a competent hardware consultant approved by the Architect and Owner to make final check of entire finish hardware installation after work has been completed
- B. After final check make all required adjustments, replacements and repairs. Leave hardware in perfect operating condition.
- C. Blemished or defective hardware will be rejected even though set in place before defects are discovered. Remove and replace with new hardware and repair any resultant to other work.
- D. The hardware dealer shall be responsible to travel to the job site once all work by the contractor has been completed to inspect the installation of the hardware and to certify that all hardware has been installed to manufacturer's recommendations and to state by letter to the architect that all hardware has been installed satisfactorily including the following:
 - 1.) All closers have been properly adjusted.
 - 2.) All closers have been set to the proper degree of swing

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. All floor strikes have been installed at doors which are using vertical rod exit devices or flush bolts.
- B. All vertical rod and rim exit devices are installed correctly and are properly adjusted.
- C. All locks are operating properly.
- D. All locks are keyed according to schedule.
- E. All flush bolts and coordinators are functioning properly.

2.2 SUBMITTALS

- A. Samples:
 - 1. Submit properly labeled samples of hardware for approval as requested by architect. Samples will be returned or delivered to the job for use.

B. Schedule:

1. As soon as practicable and no later than thirty (30) days after award of hardware contract, submit for approval six (6) copies of the finish hardware schedule complete with details. Include catalogs ,brochures and samples to describe the hardware
2. The schedule shall be prepared in accordance with the specification schedule. The schedule shall be in the vertical format. Horizontal schedules shall not be acceptable and will be rejected. The schedule shall catalog reference, type numbers, finishes and locations of each item by door reference. Schedules must list Architect door numbers
3. Fabrication and delivery of finish hardware shall not be done before obtaining approval of the schedule
4. Approval of schedule shall not relieve the contractor of the responsibility for furnishing necessary quantities, whether quantities are noted or not.

2.3 TEMPLATES

- A. Template information furnished to hollow metal and wood door manufacturers for fabrication purposes shall indicate those specific functions called for in the hardware schedule
- B. All hardware items required for installation by door manufacturer shall be delivered properly identified, to the factories of respective fabricators, at the supplier's expense and in ample time so as not to impede progress of their work.

2.4 PACKING

- A. All items of hardware shall be packaged separately, labeled with the manufacturer's name, catalog number and hardware set or item number. Each container shall include necessary fastenings required to properly install hardware along with manufacturer's installation instructions
- B. Hardware supplier shall remove through bolts prior to shipping hardware to site.

2.5 ORDERING AND DELIVERY

- A. Hardware supplier shall coordinate with the contractor well in advance to select, order and have hardware delivered to job site.
- B. All hardware required for metal doors or frames shall be made to template and furnished with machine screws.
- C. Provide aluminum thresholds where shown on drawings.

2.6 DETAIL REQUIREMENTS

- A. The hardware numbers or items enumerated in this section of the specification are taken from the following catalogs: McKinney, Architectural Builders Hardware, Schlage, Dorma, Von Duprin, Rockwood and National Guard Products.

- B. It is the intention of this specification to list all items that are required to complete this contract. Items not listed, to complete this project shall be included although they have not been specified. A similar type of hardware application shall be required.

2.7 KEYING

- A. **All permanent cylinder cores shall be furnished by the owner.** Locksets are to be furnished with LFIC construction cores. Furnish twelve (12) construction operating keys, three (3) control keys

2.8 FINISH

- A. The exposed surfaces of all hardware shall be plated BHMA as specified.
- B. Types of finish required include the following:

| | |
|-------------------|---------|
| Hinges | US26D |
| Continuous Hinges | 628 |
| Mortise Locks | US32D |
| Exit Device | US32D |
| Door Closer | 689 |
| Push/Pull | US32D |
| Protection Plates | US32D |
| Overhead Stops | 652,630 |

- C. All fasteners shall be of the same base material and finish as the product that they are being used with.

2.9 HINGES

- A. All doors shall be equipped with three (3) hinges for doors up to and including 90” and one additional hinge for each additional 30” or fraction thereof. Hinges shall have leaves of sufficient width to clear all trim at the maximum opening.
- B. All hinges shall be of 5 knuckle ball bearing construction or continuous hinges as indicated. Unless otherwise specified sizes for hinges for doors shall be as follows:

| | |
|---------------------|-------------------------------|
| Up to 3’ in width: | TA2714 4 ½ x 4 ½ (.134) |
| | T4A3786 4 ½ x 4 ½ (.180) |
| 3’ to 3’6” in width | T4A3786 4 ½ x 4 ½ (.180) |
| | T4A3786 5 x 5 (.190) |
| Above 3’6” in width | Continuous hinge as specified |

2.10 MORTISE LOCKSETS

- A. Locksets shall be Schlage L9000 series commercial mortise locksets with “06N” escutcheon trim lever

- B. Locksets shall be heavy duty mortise type with hinged, anti-friction, 3/4" throw latch bolt with anti-friction piece made of self lubricated stainless steel. Functions and designs as indicated in the hardware sets. Deadbolt functions shall be 1" projection stainless steel construction. Both deadbolt and latch bolt to extend into lock case a minimum of 3/8" when fully extended. Note: Intruder locksets must have cylinders on both sides of the door. Turn piece not accepted.
- C. Levers to be "06" design
- D. Furnish locksets with sufficient strike lip to protect door trim.
- E. The lock shall accommodate Interchangeable core seven pin cylinders.
- F. The cylinder must easily be removed from the lock without having to disassemble the chassis.
- G. All levels of master keying and construction keying are to be available as specified.
- H. All Interchangeable core cylinders shall be removed by their control key.
- I. Certifications:
 - ANSI A156.13 series 1000, grade
 - ANSI A117.1 accessibility code
 - Federal specification FF-H-106C series 160
 - Underwriter Laboratories listing for A label and lesser class single doors up to 4' x 8' California State Reference Code, 1989 (formerly title 19, California state fire marshal std.) the lever must return to 1/2" from the door Surface

2.11 CYLINDERS

- A. All cylinders to be furnished with Schlage LFIC temporary removable core.
- B. All permanent LFIC removable core cylinders to be furnished and installed by owner.**

2.12 DOOR CLOSERS

- C. Door closers shall be heavy duty type, 25 year warranty
- D. Cylinder shall be cast aluminum
- E. All closers must conform to standards UL 10C & UBC 7-2(1997) positive pressure testing.
- F. Piston shall be 1-1/2" diameter large rack teeth
- G. Main arm shall be forged also rigid forged forearm on parallel arm closer.
- H. Shaft/Pinion shall be 11/16" diameter shaft
- I. Bearings- Full complement bearings.
- J. All closers to have "all-weather" hydraulic fluid that allows hydraulics to operate in temperatures from -30 to 120 F without valve adjustment and conforms to positive pressure fire test standards UL 10C & UBC 7-2(1997)

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- K. Delayed action fluids to operate 0 to 120 F without any valve adjustment and conform to positive pressure standards UL 10C & UBC 7-2(1997)
- L. Closers for both exterior and interior doors to be ADA compliant
- M. Closers with hold open, delay to be adjustable between 85 and 110 per template
- N. All closers to have powder coated finish.

2.13 EXIT DEVICES

- A. Strikes: Roller strikes come with a plate underneath it, which prevents movement of the strike
- B. Mechanism Case: Aluminum extrusion
- C. Center Case: Shall be interchangeable with all functions
- D. Center case cover: Forged
- E. Push bar trim: Shall be stainless steel, 2-3/16" minimum height. No plastic
- F. Mechanism end cap: Zinc die cast, no plastic.
- G. Springs: Use only compression springs. No torsion springs
- H. Quiet damper: Fluid damper to eliminate most noise.
- I. Trim: Trim to be heavy duty cast lever & escutcheon thru-bolted to the device. Optional "break-away" levers to be supplied where indicated
- J. To prevent rusting: zinc dichromate to all internal components made of cold rolled steel
- K. UL listings: Underwriter's Laboratory Building Materials Directory. The products are "A" labeled. Listings are for door width up to 4'(single door) and 8' (double door)
- L. All exit devices both non-fire rated and fire rated to have deadlocking latches
- M. Non-fire rated exit devices shall be furnished with cylinder dogging where indicated. Hex key dogging shall not be allowed.
- N. All exit devices and trims shall be furnished in BHMA standard architectural finishes.
- O. Certifications: Federal Specifications: FF-H-1820, ANSI A156.3 grade 1
- P. All exit devices and trims shall carry a 3 year limited warranty

2.14 SILENCERS

- A. Hard rubber silencers shall be furnished for all hollow metal door frames where there is no weather-strip required.

2.15 LOCKSETS CYLINDRICAL TYPE

- A. All cylindrical locksets and latch sets shall be Schlage ND series extra heavy duty with "RHO" style trim.
- B. A single lock chassis shall accommodate 1-3/4" to 2-1/4" door thickness. Locksets shall be non-handed. Locksets shall have separate anti-rotation through bolts and shall have no exposed mounting screws.
- C. Locksets shall have solid cast levers without plastic inserts. Levers shall operate independently and shall have separate inside and outside lever

return springs to prevent lever sag. Outside lever handles shall have a minimum of 4-5/8" in length and shall provide a minimum of 2" clearance from the surface of the door to the inside of the lever at the midpoint. Outside lever handles may return to within 1/2" of the door surface. Levers on keyed locksets shall be removable only when the designated key is in the cylinder.

- D. When the outside lever is locked it shall rotate freely and it shall return to its horizontal position when released.
- E. A single lockset shall accommodate 6 or 7 pin conventional cylinders and all levels of master keying, construction master keying, visual key control, high security and interchangeable core. Cylinders may be easily changed by removing the lever without disassembling the lockset.
- F. A 3/4" throw latch bolt for pairs of fire doors shall be available. All locksets with a 1/2" throw latch bolt shall be listed by Underwriters Laboratories for "A" label and lesser class single doors, 4' x 10'. All locksets with 3/4" latch bolt shall be UL listed for "A" label and lesser class pairs of doors 8' x 10'
- G. Certifications:
 - Federal Specification: FF-H-106C
 - ANSI A156.2 series 4000 grade 1
 - ANSI A117.1 Accessibility Code
 - California State Reference Code, 1989 (formerly Title 19, California State Fire Marshal Standard)
- H. All locksets shall carry a five year limited warranty.

2.16 KICK PLATES/ MOP PLATES

- A. Kick plates for doors where scheduled shall be on the push side of the door unless otherwise specified. Kick plates shall be 10" x 1" ldw on pairs, 2" ldw on single door widths unless otherwise specified. All kick plates, mop plates and armor plates to have screw holes drilled and countersunk. Screws to be Phillips head, oval head undercut sheet metal screws to match plate material unless otherwise specified.

2.17 DOOR STOPS AND BUMPERS

- A. Door stops and bumpers shall be provided for every door that will strike a wall or any part of the building. Wherever possible furnish wall type bumpers with correct attachments and fasteners. Furnish door stops wherever required unless otherwise specified.
- B. Where wall stops and bumpers cannot be applied overhead stops will be required for 90' swing doors

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Apply required hardware in prepared openings in doors and frames and hang doors. Unless otherwise established mount hardware units according to NBHA "recommended locations for builders hardware.
- B. Install each hardware item in compliance with the manufacturer's instructions using fasteners provided. Wherever cutting and fitting is

required to install hardware onto or into surfaces which are later to be painted or finished in another way install each item completely and then remove and store in a safe place during the finish application. After completion of the finishes re-install each item, do not install surface mounted items until finishes have been completed on the surface.

- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrates as necessary for a proper installation and operation.
- D. Drill and countersink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards. Through bolting is not allowed
- E. Cut and fit thresholds and floor covers to profile door frames with mitered corners and hair line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items if any.
- F. Screw thresholds to substrate with no.10 or larger screws of the proper type for permanent anchorage and of the same material as the threshold.
- G. At exterior doors and elsewhere as indicated set each edge of threshold in a seal strip of butyl rubber sealant or polyisobutylene mastic sealant and remove excess.

3.2 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Lubricate moving parts with type of lubrication recommended by manufacturer (graphite dust if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.
- B. After final check make all required adjustments replacements and repairs. Leave hardware in perfect operating condition. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- C. Blemished or defective hardware will be rejected even though set in place before defect is discovered. Remove and replace with new hardware and repair damage to other work.
- D. Instruct owner's personnel on proper adjustment and maintenance of hardware and hardware finishes during final adjusting of hardware

3.3 MAINTENANCE

- A. Tools for maintenance: after hardware is installed the installer shall turn over a complete set of specialized tools used to install and adjust the hardware for owner's continued adjustment maintenance and removal and replacement of finish hardware

3.4 HARDWARE REQUIREMENTS

- A. Materials listed are building standard which are used through the facility and shall be as specified.

LIST OF MANUFACTURERS AND APPROVED SUBSTITUTIONS

| <u>Manufacturer Specified</u> | <u>Approved Substitutions</u> |
|---|--------------------------------------|
| <u>Hinges:</u> McKinney | Stanley, Hager |
| <u>Continuous Hinges:</u> ABH | National Guard, Markar |
| <u>Mortise Locksets:</u> Schlage | NONE OWNER’S STANDARD |
| <u>Cylinders, Core:</u> Schlage (Furnished & Installed by Owner) | |
| <u>Exit Devices:</u> Von Duprin | Precision, Yale |
| <u>Door Closers:</u> Dorma Door Controls | LCN, Norton |
| <u>Push Plates, Pull Plates, Kick plates, Mop plates, Flush-bolts:</u> Rockwood | Trimco, Ives |
| <u>Weatherstrip:</u> National Guard | Zero, Pemko |
| <u>Overhead Stops:</u> Architectural Builders Hardware | Rixson, Glynn-Johnson |

Hardware Set # 1
Doors # A109

Each to receive:

| <u>Qty</u> | <u>Description</u> | <u>Finish</u> | <u>Mfg</u> |
|-------------------|--|----------------------|-------------------|
| 1 ea | Continuous Hinge A240HD x Dr. Hgt. | 628 | ABH |
| 1 ea | Exit Device LD98NL x Less Trim | 630 | VD |
| 1 ea | Cylinder Hsg. 20-057 | 626 | SC |
| 1 ea | Door Pull BF158 x 12HD Mt'g | 630 | ROC |
| 1 ea | Electric Strike 9600 x 2004M x 2005M | 630 | HES |
| 1 ea | Door Closer 8916 S-DS x FC x LSN | 689 | DOR |
| 1 ea | Wire Harness QC-C1500P | | McK |
| 1 ea | Power Supply BPS-24-1 | | SN |
| 1 ea | Door Position Switch DPS-M-BK | | SN |
| 1 ea | Threshold 896 V x Dr. Width x 10/24MS/LA | Alum | NG |
| 1 ea | Weatherstrip 160 VA x Dr Perimeter | Alum | NG |
| 1 ea | Rain Drip 16A x Dr. Width +4" | Alum | NG |
| 1 ea | Point to Point Wiring Diagram | | |
| 1 ea | Card Reader (By Security Vendor) | | |

Operation: Door locked & Secure; Electric Strike Fail-Secure. Card reader when activated by valid card signals electric strike to allow ingress. Key override will allow ingress. Free egress at all times.

Hardware Set # 2

Doors # A102A, A108A

Each to receive:

| <u>Qty</u> | <u>Description</u> | <u>Finish</u> | <u>Mfg</u> |
|------------|---|---------------|------------|
| 3 ea | Hinge TA2714 x 4-1/2" x 4-1/2" | 626 | McK |
| 1 ea | Lockset L9080BDC x 06N x10-072 | 626 | SC |
| 1 ea | Door Closer 8916 AF89P x FC x LSN | 689 | DOR |
| 1 ea | Kickplate K1050 x 10" x 2"ldw x .050" x B4E x Csk | 630 | ROC |
| 1 ea | Wall Stop 406 | 630 | ROC |
| 3 ea | Door Mute 608-RKW | Gray | ROC |

Hardware Set # 3

Doors # A102, A108

Each to receive:

| <u>Qty</u> | <u>Description</u> | <u>Finish</u> | <u>Mfg</u> |
|------------|--|---------------|------------|
| 1 ea | Continuous Hinge A240HDC x Dr. Hgt. | 628 | ABH |
| 1 ea | Lockset L9080BDC x 06N x 10-072 | 626 | SC |
| 1 ea | Door Closer 8916 x AF89P x FC x LSN | 689 | DOR |
| 1 ea | Kickplate K1050 x 10" x 2" ldw x .050" x B4E x Csk | 630 | ROC |
| 1 ea | Wall Stop 406 | 630 | ROC |
| 1 ea | Smoke Seal 5050-B x Dr Perimeter | | NG |

Hardware Set # 4

Doors # A107, A111

Each to receive:

| <u>Qty</u> | <u>Description</u> | <u>Finish</u> | <u>Mfg</u> |
|------------|---|---------------|------------|
| 1 ea | Continuous Hinge A240HDC x Dr. Hgt. | 628 | ABH |
| 1 ea | Privacy Latchset L9056BDC x 06N x L283-722 x L583-363 x 10-072 | 626 | SC |
| 1 ea | Door Closer 8916 x AF89P x FC x LSN | 689 | DOR |
| 1 ea | Mop plate K1050 x 4" x 1" ldw x .050" x B4E x Csk | 630 | ROC |
| 1 ea | Door Mute 608-RKW | Gray | ROC |

Hardware Set # 5

Doors # A112

Each to receive:

| <u>Qty</u> | <u>Description</u> | <u>Finish</u> | <u>Mfg</u> |
|------------|--|---------------|------------|
| 1 ea | Continuous Hinge A240HDC x Dr. Hgt. | 628 | ABH |
| 1 ea | Storeroom Lock L9080BDC x 06N x 10-072 | 626 | SC |
| 1 ea | Door Closer 8916 x AF89 x FC x LSN | 689 | DOR |
| 1 ea | Kickplate K1050 x 10" x 2" ldw x .050" x B4E x Csk | 630 | ROC |
| 1 ea | Wall Stop 406 | 630 | ROC |
| 3 ea | Door Mute 608-RKW | Gray | ROC |

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**Hardware Set # 6
Doors # A113, A114**

Each to receive:

| <u>Qty</u> | <u>Description</u> | <u>Finish</u> | <u>Mfg</u> |
|-------------------|---|----------------------|-------------------|
| 3 ea | Hinge TA2714 x 4-1/2" x 4-1/2" | 626 | McK |
| 1 ea | Storeroom Lockset L9080BDC x 06N x 10-072 | 626 | SC |
| 1 ea | Door Closer 8916 x AF89 x FC x LSN | 689 | DOR |
| 1 ea | Wall Stop 406 | 630 | ROC |
| 3 ea | Door Mute 608-RKW | Gray | ROC |

**Hardware Set # 7
Doors # A105**

Each to receive:

| <u>Qty</u> | <u>Description</u> | <u>Finish</u> | <u>Mfg</u> |
|-------------------|---|----------------------|-------------------|
| 6 ea | Hinge TA2714 x 4-1/2" x 4-1/2" x NRP | 626 | McK |
| 1 ea | Storeroom Lockset L9080BDC x 06N x 10-072 | 626 | SC |
| 2 ea | Flushbolt 555 x 12" | 626 | ROC |
| 1 ea | Door Closer 8916 AF89P x FC x LSN (Active Leaf) | 689 | DOR |
| 1 ea | Dustproof Strike 570 | 626 | ROC |
| 2 ea | Door Mute 608-RKW | Gray | ROC |
| * | Astragal furnished by hollow metal door manufacturer | | |

**Hardware Set # 8
Doors # A106**

Each to receive:

| <u>Qty</u> | <u>Description</u> | <u>Finish</u> | <u>Mfg</u> |
|-------------------|---|----------------------|-------------------|
| 6 ea | Hinge TA2714 x 4-1/2" x 4-1/2" x NRP | 626 | McK |
| 1 ea | Classroom Lockset L9070BDC x 06N x 10-072 | 626 | SC |
| 2 ea | Flushbolt 555 x 12" | 626 | ROC |
| 1 ea | Door Closer 8916 x AF89P x FC x LSN (Active Leaf) | 689 | DOR |
| 1 ea | Dustproof Strike 570 | 626 | ROC |
| 2 ea | Door Mute 608-RKW | Gray | ROC |
| * | Astragal furnished by hollow metal door manufacturer | | |

END OF SECTION 087100

SECTION 092000 – GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board and non-load-bearing steel framing system.

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.
- B. Protect and store cold-formed metal framing and drywall trim and accessories from corrosion, deformation and other damage during delivery, storage and handling per requirements of AISI's "Code of Standard Practice".

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturers written instructions, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

1. Steel Framing and Furring:
 - a. Clark Dietrich Building Systems.
 - b. Marino Ware.
 - c. National Gypsum Company.
2. Gypsum Board and Related Products:
 - a. CertainTeed Corporation.
 - b. George-Pacific Building Products.
 - c. National Gypsum Company.
 - d. USG Corporation.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 and ASTM C 840 for conditions indicated.
 1. Steel Sheet Components: Comply with ASTM C 645 requirements for steel unless otherwise indicated.
- B. Steel Studs and Runners: ASTM C 645, zinc coated, with flange edges of studs bent back 90 deg and doubled over to form 3/16-inch minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
 1. Thickness: 20 gauge unless otherwise indicated.
 2. Depth: As indicated.
- C. Fasteners: Provide fasteners of type, material, size, corrosion resistance, holding power and other properties required to fasten steel framing and furring power members securely to substrates involved; complying with the recommendations of gypsum drywall manufacturers for applications indicated. Fasteners shall be galvanized or cadmium plated.

2.3 GYPSUM BOARD

- A. Size: Provide lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
 1. Thickness: Provide gypsum board in thicknesses indicated to comply with ASTM C 840 for application system and support spacing indicated.
- B. Gypsum Board, Type X: ASTM C 1396.

1. Thickness: 5/8-inch, unless otherwise indicated.
2. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

- A. Cornerbead and Edge Trim for Interior Installation: Provide corner beads, edge trim and control joints which comply with ASTM C 1047 and requirements indicated below:
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. Control Joint: One-piece 1/4-inch wide, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.5 JOINT TREATMENT MATERIALS

- A. General: Provide materials complying with ASTM C 475, ASTM C 840, and recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.
- B. Joint Tape: Paper reinforcing tape, unless otherwise indicated.
1. Use pressure sensitive or staple-attached open-weave glass fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.
- C. Drying-Type Joint Compounds: Factory-prepackaged vinyl-based products complying with the following requirements for formulation and intended use.
1. Ready-Mix Formulation: Factory-premixed product.
 - a. Taping compound formulated for embedding type and for first coat over fasteners and face flanges of trim accessories.
 - b. Topping compound formulated for fill (second) and finish (third) coats.

- c. All-purpose compound formulated for both taping and topping compounds.

2.6 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
 - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrate.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in-anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

3.2 INSTALLATION OF STEEL FRAMING, GENERAL

- A. Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer.
- D. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below:
- E. Contractor shall contact the Architect to determine locations of additional control joints to comply with the manufacturer's specifications.

3.3 INSTALLATION OF STEEL FRAMING FOR WALLS AND PARTITIONS

- A. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other construction.

- B. Installation Tolerances: Install each steel framing and furring member so that fastening surface do not vary more than 1/8 inch from plane of faces of adjacent framing and/or the dimensions on the drawings as determined by the Architect.
- C. Install steel studs and furring in sizes and at spacings indicated but not less than that required by referenced steel framing installation standard.
 - 1. Steel Stud Spacing: 16 inches on center.
- D. Install steel studs so that flanges point in the same direction and gypsum boards can be installed in the direction opposite to that of the flange.

3.4 INSTALLATION AND FINISHING OF GYPSUM BOARD, GENERAL

- A. Comply with ASTM C 840 and GA-216.
- B. Install gypsum board with face side out. Butt boards together for a light contact at edges and ends with not more than 1/16-inch open space between boards. Do not force into place.
- C. Locate edge and end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- D. Form control and expansion joints at locations indicated, with space between edges of adjoining gypsum boards.
- E. Cover both faces of support framing with gypsum board in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area.
 - 2. Fit gypsum board around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum board to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- F. Attachment to Steel Framing: Attach gypsum board so leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.
- G. Isolate perimeter of non-structural drywall partitions at structural abutments. Provide 1/4-inch to 1/2-inch space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant.
- H. Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.5 METHODS OF GYPSUM BOARD APPLICATION

- A. Single-Layer Application: Install gypsum wallboard as follows.
 - 1. On partitions/walls, apply gypsum board vertically (parallel to framing), or horizontally (perpendicular to framing) unless otherwise indicated or directed by the Architect, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - 2. Fastening Methods: Apply gypsum boards to supports with steel drill screws.

3.6 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturers written instructions.
- B. Install corner beads at external corners.
- C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where "U-bead" (semi-finishing type) is indicated.
 - 1. Install "LC" bead where drywall construction is tightly abutted to other construction and back flange can be attached to framing or supporting substrate. Provide where drywall construction abutts concrete masonry units.
 - 2. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).
- D. Install U-bead where indicated, and where exterior gypsum board edges are not covered by applied moldings or indicated to receive edge trim with face flanges covered with joint compound.
- E. Install control joints at locations indicated, or if not indicated, at spacings and locations required by referenced gypsum board application and finish standard, and approved by the Architect for visual effect.

3.7 FINISHING OF GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840.
 - 1. Level 4: For all gypsum board surfaces, unless otherwise indicated.
- E. Finish interior gypsum wallboard by applying the following joint compounds in three coats (not including prefill of openings in base), and sand between coats and after last coat:
 - 1. Embedding and First Coat: Ready-mix drying-type all-purpose or taping compound.
 - 2. Fill (Second) Coat: Ready-mix drying-type all-purpose or topping compound.
 - 3. Finish (Third) Coat: Ready-mix drying-type all-purpose or topping compound.
- F. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.

3.8 PROTECTION

- A. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall construction being without damage or deterioration at time of Substantial Completion.

END OF SECTION 092000

SECTION 095113 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Acoustical panels and exposed suspension systems for ceilings.

B. Related Requirements:

1. Division 25 Sections for air outlets and inlets, grilles, registers, and diffusers in acoustical panel ceilings specified under the Heating, Ventilating and Air Conditioning.
2. Division 26 Sections for interior lighting fixtures in acoustical ceilings.

- C. Alternates: Refer to Section 004116 “General Construction Bid Form – Proposal” for Alternate Bids on this Work.

1.3 UNIT PRICES AND ALLOWANCES

- A. Unit Price information for acoustical panel ceiling system replacement is included in the “General Construction Bid Form – Proposal.”
- B. Material allowance information for acoustical panel ceiling panel replacement is included in the “General Construction Bid Form – Proposal.”

1.4 SUBMITTALS

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

- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch square Samples of each type, pattern, and texture.
2. Exposed Suspension-System Members: Set of 6-inch-long samples of each type, finish and color.

1.5 MAINTENANCE MATERIALS

- A. Furnish extra materials that match products installed and that is packaged with protective covering for storage and is identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 3 percent of quantity installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has successfully completed acoustical ceilings similar in material, design, and extent to those indicated for Project.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components to project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at levels indicated for Project when occupied for its intended use.

1.9 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and partition assemblies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL CEILING UNITS, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Acoustical Panel Standard: Provide manufacturers' standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from the test surface according to ASTM E 795.

2.3 ACOUSTICAL PANELS

A. Basis-of-Design Product: Subject to compliance with requirements, products of the manufacturer listed below form the basis of the Contract Documents

1. Armstrong World Industries, Inc.

B. Products of the following manufacturers, provided they comply with requirements of the documents, will be among those considered acceptable as substitutes.

1. CertainTeed Corporation.
2. USG Corporation.

C. For acoustical ceiling units whose appearance characteristics are indicated by reference to ASTM E 1264 designations for pattern and not by limiting to the naming of one or more products or manufacturers. Provide Architect's selections from each named manufacturer's standard products of type, color, and pattern.

1. AP-1 Acoustical Panels: Non-directional "Fine Fissured" medium texture surface with washable matte white finish. Panels shall have a square edge profile for lay-in installation in exposed suspension system.
 - a. Armstrong; Item No. 1729.
 - b. Size: 24" x 48" x 5/8".

- c. NRC = 0.55.
- d. CAC = 35.

2.4 METAL SUSPENSION SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation.
 - 3. USG Interiors, Inc.
- B. Metal Suspension System Standard: Provide manufacturer's standard, direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Manufacturer's standard main and cross-runners roll-formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.
 - 1. Structural Classification: Intermediate Duty.
 - 2. End Condition of Cross-Runners: Override (stepped) type.
 - 3. Cap Material: Cold-rolled steel or aluminum.
 - 4. Cap Finish: Painted white.
- D. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit type of edge detail and suspension system indicated.
 - 1. Color: To match acoustic panels.
 - 2. At concrete masonry units with bullnose corners provide custom edge molding to fit the radius of the block and eliminate the open space.

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
- B. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

1. Gage: Provide wire sized so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct-Hung), will be less than yield stress of wire, but provide not less than 0.106-inch diameter (12 gage).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half-width panels at borders, and comply with final layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636, manufacturer's written instructions, and CISCA "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of

trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

4. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures. A minimum tie wire wrap of 4 total turns at each location shall be provided.
 5. Do not attach hangers to roof deck. Attach hangers to structural members.
 6. Space hangers not more than 4'-0" o.c. along each member supported directly from hangers, unless otherwise shown, and provide hangers not more than 8 inches from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical units.
1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels to fit accurately at borders and penetrations to provide a neat, precise fit. Review drawings for all penetrations including penetrations in the Plumbing, HVAC, and Electrical Contracts.
1. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touch-up of minor finish damage.

- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096500 – RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Vinyl composition floor tile.

B. Related Requirements:

- 1. Section 96513 “Resilient Base and Accessories” for wall base installed with resilient flooring.

1.3 SUBMITTALS

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

- B. Samples for Initial Selection: For each type of floor tile indicated.

- C. Samples for Verification: Full size units of each color and pattern of floor tile required.

- D. Maintenance Data: For each type of floor tile to include in maintenance manual.

1.4 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.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

- B. Source Limitations: Provide each type of resilient flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg. F or more than 90 deg. F. Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. Close spaces to traffic during floor tile installation.
- C. Close spaces to traffic for 48 hours after floor tile installation.
- D. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM 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.

2.2 VINYL COMPOSITION FLOOR TILE

- A. Manufacturer: 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. Armstrong World Industries, Inc.

- 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. Basis-of-Design Tile Series:
 - 1. Armstrong World Industries, Inc.; Standard Excelon Imperial Texture.
- G. Slip Resistance Properties: Static coefficient of friction value of 0.60 or greater as measured in accordance with ASTM D 2047.
- H. Colors and Patterns: Install resilient floor tile in patterns indicated on the Floor Finish Drawings. Colors and patterns shall be as selected by Architect from manufacturer's full range of standard colors in the specified patterns and series.

2.3 ACCESSORIES

- A. Resilient Edge Strips: Solid vinyl edging, tapered edge, color as selected by Architect from standard colors available; not less than 1 inch wide.
 - 1. Provide uniform slope between two adjoining finished floor levels.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compound: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. VCT Tile Adhesives: 50 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compounds.
 2. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturers 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 substrates alkalinity falls within range on pH scale recommended by manufacturer in writing.
 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 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.
1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturers written instructions and recommendations 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.
- C. Match floor tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles
 - 1. Multiple Color Floors: Lay tile with grain running in one direction.
 - 2. Single Color Floors: Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).
- 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. 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.

3.4 INSTALLATION OF ACCESSORIES

- A. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturers written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.

- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Protect flooring against damage during construction period to comply with resilient flooring manufacturer's directions.
- E. Clean resilient flooring not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Clean resilient flooring by method recommended by resilient flooring manufacturer.

END OF SECTION 096500

SECTION 096513 – RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient wall base and resilient molding accessories.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples.

1.3 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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

- B. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong Flooring, Inc.
 - 2. Tarkett North America.
 - 3. Nora Systems, Inc.
 - 4. Roppe Corporation, USA.
 - 5. VPI Corporation.
- B. Resilient Base Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style: Cove; provide in areas with resilient tile flooring.
- C. Thickness: 0.125 inch.
- D. Height: As indicated on the Room Finish Schedule.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Surface: Smooth.
- I. Colors: As selected by Architect from full range of industry colors.

2.2 RUBBER MOLDING ACCESSORIES

- A. Description: Rubber carpet edge for glue-down applications, nosing for carpet, nosing for resilient flooring, reducer strip for resilient flooring, joiner for tile and carpet, transition strips, etc.
- B. Profile and Dimensions: As indicated.
- C. Locations: Provide rubber-molding accessories in areas indicated.
- D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Resilient Base Adhesives: Not more than 50 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturers written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Damp-mop surfaces to remove marks and soil.

- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 096513

SECTION 096730 – EPOXY FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Epoxy flooring system.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 “Project Management and Coordination.”
1. Review manufacturers written instructions for substrate preparation and environmental conditions affecting epoxy floor installation.
 2. Review details of integral cove base.
 3. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, base details, etc.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
1. Include manufacturer's technical data, installation instructions, and recommendations for epoxy flooring material required.
- B. Samples for Verification: For epoxy flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.
- C. Material Certificates: For each epoxy flooring component, from manufacturer.
- D. Maintenance Data: For epoxy flooring to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by flooring system manufacturer.

1. Engage an Installer who is certified in writing by epoxy flooring manufacturer as qualified to apply flooring system indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Comply with epoxy flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting epoxy flooring application.
- B. Close spaces to traffic during flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Flammability: Self-extinguishing according to ASTM D 635.

2.2 EPOXY FLOORING

- A. Epoxy Flooring System: Two-component, 100 percent solids epoxy containing no solvents formulated with dehydrated specially graded silica to form a workable matrix applied over concrete floors with a slip-proof surface.
 1. Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Industrial Floor Corporation; POXEPLATE Epoxy Flooring System.
- B. System Characteristics:
 1. Wearing Surface: Manufacturers standard slip-resistant surface.
 2. Flooring System Thickness: 1/16-inch.
 3. Integral Cove Base: 4 inches high.
 4. Color: As selected by Architect from manufacturer's full range of standard colors.

- C. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
1. Compressive Strength: 19,000 psi according to ASTM C 579.
 2. Tensile Strength: 9,000 psi according to ASTM C 307.
 3. Flexural Strength: 8,900 psi according to ASTM C 790.
 4. Water Absorption: 0.09 percent (max.) according to ASTM C 413.
 5. Abrasion Resistance: 0.2 Gm (maximum) weight loss according to ASTM D 4060.
 6. Hardness: 80-85, Shore D according to ASTM D 2240.
- D. Primer: Type recommended by epoxy flooring manufacturer for substrate and epoxy flooring system indicated.

2.3 ACCESSORY MATERIALS

- A. Patching and Fill Material: As approved by epoxy flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of epoxy flooring systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare and clean substrates in accordance with epoxy flooring manufacturer's written instructions for substrate indicated to ensure adhesion. Provide clean, dry, substrate for epoxy flooring application.

- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 - 1. Scarify, grind and/or shot-blast; clean and prepare existing concrete floor to remove harmful foreign matter. Vacuum to remove dust. Clean and prepare wall material in accordance with manufacturers written instructions.
 - 2. Repair damaged and deteriorated concrete according to epoxy flooring manufacturers' written instructions.
 - 3. Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Primer: Apply epoxy primer over prepared substrates (floor and cove base) at manufacturer's recommended spreading rate (15 to 20 mil thickness).
- B. Apply epoxy floor system in accordance with manufacturers written instructions to produce a uniform, wearing surface of thickness specified. Overlay the floor areas using epoxy flooring at thickness of 1/16-inch. All edges shall be "keyed" or "feathered" to achieve a smooth transition between existing and new flooring.
 - 1. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with epoxy flooring manufacturer's written instructions.
- C. Integral Cove Base: Install epoxy integral matching cove base with an approximate 1-inch corner radius along perimeter walls, columns, or other designated locations. Cove base shall be 1/16-inch at the upper heights and increased in thickness downward to the corner radius.
 - 1. Cove base height shall be as indicated above.
 - 2. Apply cove internal and external corners.

3.4 PROTECTION

- A. Protect epoxy flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by epoxy flooring manufacturer.

END OF SECTION 096730

SECTION 099000 – PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems and finishing of all exposed interior and exterior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified under other Sections.
- B. Paint all exposed surfaces except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from custom colors or finishes available.
 - 1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment in rooms and areas scheduled to be painted.
 - 2. In areas indicated as "exposed structure" and "painted," the Architect will select one color for all materials at the ceiling and a different color for walls.
- C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
 - 1. Prefinished items not to be painted include, but is not limited to, the following factory-finished components:
 - a. Review all specification sections for factory-finished materials.
 - 2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
 - a. Furred areas.
 - b. Pipe spaces.

3. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections:

1. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
2. Section 081113 "Steel Doors and Frames" for shop priming of metal doors and frames and prefinished metal doors where indicated.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include technical information, preparation requirements, and application instructions.

B. Samples for Initial Selection: For each type of topcoat product in the form of manufacturer's color charts.

1. After color selection, the Architect will furnish manufacturers catalog numbers for surfaces to be coated.

C. Samples for Verification: For each type of painting system and in each color and gloss of topcoat.

1. Submit samples of each color selected on an 8-1/2 by 11 inch rigid glossy paper substrate.
2. Label each sample for location and application area.

D. Safety Sheets: Submit manufacturer's Safety Data Sheets (SDS).

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide primers and undercoat paint produced by or recommended and approved by the same manufacturer as the finish coats.

B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect in writing of problems anticipated using the materials specified.

C. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude equal products of other manufacturers listed in the specifications.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when the temperature of surfaces to be painted and ambient air temperatures are between 50 deg F and 90 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent, at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, products of the manufacturer listed below form the basis of the Contract Documents.
 1. The Sherwin-Williams Company (S-W).
- B. Products of the following manufacturers, provided they comply with requirements of the documents, will be among those considered acceptable as substitutes.
 1. Benjamin Moore and Co. (Moore).
 2. PPG Paints (PPG).

2.2 PAINT, GENERAL

- A. Material Compatibility: Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 1. For each coat in paint topcoat manufacturers for use shall recommend system products in writing in paint system and on substrate indicated.

- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Flat Paints and Coatings: 50 g/L.
 2. Non-flat Paints and Coatings: 150 g/L.
 3. Dry-Fall Coatings: 150 g/L.
 4. Primers, Sealers, and Undercoaters: 100 g/L.
 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 100 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.

2.3 MASONRY BLOCK FILLER

- A. High-Performance Latex Block Filler: Heavy-duty latex block fillers used for filling open textured interior and exterior concrete masonry block before application of top coats:
1. S-W: PrepRite Latex Block Filler.

2.4 PRIMERS

- A. Latex-Based Interior Primer: Latex-based primer coating used on interior gypsum drywall under low lustre latex paint or alkyd semi-gloss enamel.
1. S-W: ProMar 200 Zero VOC Interior Latex Primer.
- B. Universal Metal Primer: Acrylic primer used to prime exterior and interior ferrous and zinc-coated (galvanized) metal surfaces.
1. S-W: Pro Industrial Pro-Cryl Universal Primer.
- C. Universal Acrylic Primer: Self cross-linking acrylic primer water-based coating used on interior applications under waterborne acrylic paint.
1. S-W: Pro Industrial Pro-Cryl Universal Primer.

2.5 INTERIOR FINISH PAINT MATERIAL

- A. Semi-Gloss Acrylic Latex Enamel: Ready-mixed, non-yellowing, spatter resistant latex enamel (not including metal doors and frames).
1. S-W: DTM Acrylic Finish, semi-gloss.

- B. High Performance Acrylic Latex Enamel: Ambient cured, single component 100% acrylic coating (use for metal doors and frames).
 - 1. S-W: Pro Industrial Acrylic Semi-Gloss Enamel.

- C. Latex-Based Eggshell Interior Wall Paint: Ready-mixed, latex-based paint for use as an eggshell finish over concrete and masonry surfaces, including filled concrete masonry block and over prime-coated gypsum board.
 - 1. S-W: ProMar 200 Zero VOC Interior Latex Eg-Shel.

- D. Acrylic Dry-Fall, Egg Shell: Waterborne acrylic, low odor, abrasion resistant, VOC compliant coating, dry falls in 10-15 feet.
 - 1. S-W: Pro Industrial Multi-Surface Acrylic Eg-Shel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

- B. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturers written instructions and recommendations in “MPI Architectural Painting Specification Manual” applicable to substrates and paint systems indicated.

- B. Remove hardware and hardware accessories, plates, lighting fixtures, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection prior to surface preparation and painting.
 - 1. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

- C. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and re-prime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
 2. Cementitious Materials: Prepare concrete masonry block and concrete surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
 3. Ferrous Metals: Clean non-galvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
 - a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
 4. Gypsum Board: All surfaces must be free of sanding dust, and joint treatment cement should be thoroughly dry.
 - a. Damaged or defective surfaces are to be repaired by spackling or by other appropriate measurements.
 5. Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
 6. Previously Painted Steel: All surfaces must be free of dust, dirt, grease, and oil and cleaned in accordance with SSPC-SP1-63, "Solvent Cleaning," followed by removal of all loose, scaling paint by hand scraping, or by the use of power tools. Rusted surfaces shall be cleaned in accordance with SSPC-SP2-63, "Hand Tool Cleaning," or SSPC-SP-63 "Power Tool Cleaning." Coat surfaces where all traces of rust cannot be removed with rust pretreatment product approved by manufacturer.

7. Previously Painted CMU Block Surfaces: Remove all peeling and scaling paint by scraping and sanding. All surfaces shall be free from greasy and oily deposits. Structural cracks and holes shall be filled with appropriate patching compound approved by paint manufacturer, then spot primed with appropriate primer or finish coat.
- D. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.
 1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
 3. Use only thinners approved by the paint manufacturer, and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 1. Surface treatments, and finishes are indicated in "schedules" and on the drawings and specified herein. Review all drawings for patterns and graphics.
 2. Provide finish coats that are compatible with primers used.
 3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
 4. Apply additional multiple coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces. Additional multiple coats applied shall be without any increase in the contract price.

5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
 6. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
 7. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
 8. Omit primer on metal surfaces that have been shop-primed and touch up painted.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.
- E. Painting Mechanical and Electrical Work: Paint items exposed in occupied spaces including, but not limited to, the following:
1. Mechanical Work:
 - a. Uninsulated metal and plastic piping.
 - b. Pipe hangers and supports.
 - c. Exposed ductwork.
 - d. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - e. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - f. Access panels.
 2. Electrical Work:
 - a. Conduit and fittings.

- b. Electrical equipment that is indicated to have a factory-primed finish for field painting.
 - c. Access panels.
 - d. Panelboards.
- F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled and provide a surface capable of receiving finish coats with a continuous film free of openings and perforations.
- G. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.
- H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Finish coats shall have an eggshell texture except where a gloss or semi-gloss surface is specified.
- I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.4 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
- 1. The Owner may engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the Contractor.
 - 2. The testing laboratory will perform appropriate tests for the following characteristics as required by the Owner:
 - a. Quantitative materials analysis.
 - b. Abrasion resistance.
 - c. Flexibility.
 - d. Washability.
 - e. Absorption.
 - f. Dry opacity.

- g. Accelerated yellowness.
 - h. Alkali and mildew resistance.
3. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are noncompatible.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paint by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing or replacing, and refinishing, as approved by the Architect, and leave in an undamaged condition.
- D. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
- E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems for the various substrates, as indicated. For the existing building indicated as being painted the existing finish will be considered the primer after all necessary touch up and surface preparation.
- B. Concrete Masonry Units (New and Existing):
 - 1. Semi-Gloss Acrylic Enamel Finish: 2-coats over filled surface with total dry film thickness not less than 3.5 mils, excluding filler coat.
 - a. Block Filler: High-Performance Latex Block Filler. (Apply on new CMU only).
 - b. First Coat: Latex-Based Eggshell Interior Wall Paint.
 - c. Second Coat: Latex-Based Eggshell Interior Wall Paint.

- C. Gypsum Drywall Systems (New):
1. Low-Lustre Latex Finish: 2-coats over primer with total dry film thickness not less than 2.4 mils.
 - a. Primer: Latex-Based Interior Primer. (Apply on new gypsum board only).
 - b. First Coat: Latex-Based Eggshell Interior Wall Paint.
 - c. Second Coat: Latex-Based Eggshell Interior Wall Paint.
- D. Ferrous Metal and Exterior Exposed Ductwork:
1. Semi-gloss Enamel Finish: 2-coats over primer with total dry film thickness not less than 2.5 mils.
 - a. Primer: Universal Metal Primer.
 - b. Undercoat: Semi-Gloss DTM Acrylic Latex Enamel.
 - c. Finish Coat: Semi-Gloss DTM Acrylic Latex Enamel.
- E. Exposed Roof Structure: Includes existing structural steel framing and galvanized metal roof deck.
1. Acrylic Dry-Fall, Egg Shell Finish: Two coats with a total dry film thickness of 1.5 – 2.3 dry mils per coat.
 - a. Primer: Universal Acrylic Primer (On existing galvanized metal roof deck).
 - 1) Spot prime bare metal areas on structural steel.
 - b. First Coat: Acrylic dry-fall, eggshell.
 - c. Second Coat: Acrylic dry-fall, eggshell.
- F. H. M. Doors and Frames:
1. High Performance Semi-gloss Enamel: 2-coats over primer with total dry film thickness not less than 2.5 mils.
 - a. Primer: Universal Metal Primer.
 - b. Undercoat: High Performance Semi-Gloss Acrylic Enamel.
 - c. Finish Coat: High Performance Semi-Gloss Acrylic Enamel.

END OF SECTION 099000

SECTION 101100 – VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Porcelain enamel steel markerboards.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes and accessories for visual display boards.

B. Shop Drawings: For visual display boards.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Show location of panel joints.
3. Include sections of typical trim members.

C. Samples for Initial Selection: For each type of visual display board indicated, for units with factory-applied color finishes, and as follows:

1. Samples of facings for each visual display panel type, indicating color.

D. Sample Warranties: For manufacturer's special warranties.

E. Maintenance Data: For visual display units to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by the manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver custom-sized, factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on reviewed Shop Drawings.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display boards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display boards by field measurements before fabrication.
1. Verify exact sizes, including thickness of all interactive media boards (and TVS) scheduled to be provided by the Owner prior to fabrication.
 2. Coordinate custom sizes of markerboards to fit tight to, and flush with, Owner supplied media boards.

1.7 WARRANTY

- A. Special Warranty for Porcelain Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces become slick or shiny.
 - c. Surfaces exhibit crazing, cracking, or flaking.
 2. Warranty Period: Life of building.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Low-Emitting Materials: Fabricate manufactured particleboard and fiberboard with adhesives and composite wood products containing no urea formaldehyde.

- B. Surface-Burning Characteristics: Comply with ASTM E 84 testing by a qualified testing agency with Flame-Spread Index of 25 or less and Smoke-Developed Index of 450 or less.

2.2 MANUFACTURERS

- A. Source Limitations: Obtain each type of visual display boards from single source from single manufacturer.
- B. 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. AARCO Products, Inc.
 - 2. Claridge Products & Equipment, Inc.
 - 3. Marsh Industries, Inc.

2.3 VISUAL DISPLAY BOARD MATERIALS

- A. Porcelain Enamel Marker Boards: Manufacturers standard balanced, high-pressure laminated porcelain enamel marker boards of 3-ply construction consisting of facing sheet, core material and backing.
- B. Facing Sheet: Provide facing sheet of 24-gage enameling grade steel sheet especially processed for temperatures used in coating porcelain on steel. Coat the exposed face with a 3-coat process consisting of primer, ground coat and color cover coat, and the concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to the steel at the manufacturer's standard firing temperatures, but not less than 1,200 deg.F.
 - 1. Basis-of-Design Product: (To establish standard of quality only).
 - a. Claridge Products and Equipment, Inc.; LCS-3 Porcelain Enamel Steel Face Sheet with #75 low gloss writing surface, or approved equal.
 - b. Cover Coat Color: The surface coat shall be white in color with a low gloss, non-reflective finish.
- C. Core: Manufacturer's standard 7/16-inch thick Class 'A' Medium Density Fiberboard core material made with binder containing no urea formaldehyde.
 - 1. Backing Sheet: Provide manufacturer's standard 0.005-inch thick minimum aluminum foil backing.
 - 2. Laminating Adhesive: Provide the manufacturer's standard moisture-resistant thermoplastic type adhesive.

- D. Aluminum Frames and Trim: Fabricate from not less than 0.062-inch thick-extruded aluminum; size and shape as indicated, to suit type of installation. Provide straight, single length units wherever possible; keep joints to a minimum.
1. Clear Anodized Finish: Furnish exposed aluminum trim, accessories and fasteners with the manufacturer's standard satin anodized finish with clear anodic coating complying with AA requirements for Class II Architectural Coating (AA-A31).
 - a. "J" Molding: 0.050 inch thick
 - b. Include all moldings adjoining the markerboards.
 2. Marker-Tray: Furnish manufacturer's standard continuous box type aluminum marker-tray with slanted front and cast aluminum end closures for each marker board. Extend marker-tray on boards as indicated on the drawings.
- E. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall covering manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 TACK STRIPS

- 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. Tack Strips: Bangor Cork; B-912 Display Rail.
 2. Tackable Insert: Forbo North America; Forbo Bulletin Board.
- B. Aluminum Tack Strip: Manufacturer's standard, extruded-aluminum tack strip with tackable insert.
- C. Size: 2 inches high by length indicated on the Drawings.
- D. End Stops: Aluminum.

2.5 FABRICATION

- A. Porcelain Enamel Marker Boards: Laminate facing sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Assembly: Provide factory-assembled marker boards, and tackboard units, except where field-assembled units are required.

1. Joints: Make joints only where total length exceeds the maximum manufactured length. Fabricate with the minimum number of joints, balanced around the center of the board, as acceptable to the Architect.
 - a. Provide hidden spline between abutting sections of porcelain enamel marker boards with no additional vertical trim.
- C. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display surfaces.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturers written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display boards and wall surfaces.

3.3 INSTALLATION

- A. General: Install visual display boards according to manufacturers written instructions, in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim and accessories necessary for a complete installation.
- B. Field-Assembled Visual Display Units: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on the approved Shop Drawings.
 2. Provide manufacturer's trimless spline joint at joints between markerboards of combination units.
- C. Tack Strips: Install tack strips at mounting heights indicated on Drawings. Attach to wall surface with fasteners at not more than 16 inches o.c.

3.4 CLEANING AND PROTECTION

- A. Verify that accessories required for each unit have been properly installed and that operating units function properly.
- B. Clean visual display boards according to manufacturer's written instructions. Break-in marker boards only as recommended by the manufacturer.
- C. Touch up factory-applied finishes to restore damaged or soiled areas.
- D. Cover and protect visual display boards after installation and cleaning.

END OF SECTION 101100

SECTION 101423 – PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Acrylic panel signs.

B. Related Requirements:

- 1. Section 015000 "Temporary Facilities and Controls" for temporary project identification signs.

1.3 SUBMITTALS

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

- B. Shop Drawings: For panel signs and field-applied, cast PVC film characters.

- 1. Include fabrication and installation details and attachment to other work.
- 2. Show message list, typestyles, graphic elements, including raised characters and braille, and layout for each sign at least half size.
 - a. See Contract Drawings for actual room name and number identification to be used for acrylic panel sign message list.

- C. Samples for Verification: For each type of sign assembly showing all components and with required color and finish in manufacturer's standard size unless otherwise indicated and as follows:

- 1. Panel Signs: Full-size Sample.

- D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

- E. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.5 WARRANTY

- A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of signs and plaques that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors and sign lamination.
 - 2. Warranty Period:
 - a. Panel Signage: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ’s “2010 ADA Standards for Accessible Design” and ICC A117.1.

2.2 MANUFACTURERS

- A. Basis-of Design Products: Products of the manufacturer listed below form the basis of the Contract Documents.
 - 1. Bayuk Graphic Systems, Inc.; CW Series Product Line
- B. Products of the following manufacturers, provided they comply with requirements of the documents, will be among those considered acceptable as substitutes.
 - 1. FASTSIGNS International, Inc.
 - 2. Intelligent Signage, Inc.
 - 3. iSIGN.

2.3 ACRYLIC PANEL SIGNS

- A. Acrylic Panel Sign: Sign with smooth, uniform surfaces; with message and characteristics having uniform faces, sharp edges, and precisely formed lines and profiles.
- B. Permanent Signage for Interior Locations: Comply with the following:
1. Letter Height: As shown on drawings.
 2. Braille: Grade II braille dots, domed or rounded in shape.
 3. Size of Sign: As shown on the drawings.
 4. Font: Helvetica Medium upper case.
 5. Border: None.
 6. Corners: Square.
 7. Finish: Characters and background: non-glare, matte finish.
 8. Mounting Height: 5'-0" above finished floor to centerline of sign.
 - a. Verify all mounting heights with Architect.
 9. Mounting: Concealed type using double sided tape and panel adhesive.
 10. Contrast: Letters, numbers, and symbols shall contrast with their background as set forth by the Americans with Disabilities Act standards.
 11. Material: Acrylic for sign panels shall be non-glare, weather resistant thermoplastic of uniform thickness, capable of withstanding direct exposure to sunlight and sudden temperature changes. Material shall meet the requirements of UL 94 HB and for Safety Glazing as defined by ANSI Z97.1.
 12. Colors: Two per sign to match color chips from the Architect.
- C. Fabrication: Sign panels shall be unframed, consisting of two laminated acrylic panels.
1. Face Plate: Manufacturers standard non-glare acrylic, 1/8-inch thick.
 - a. Text shall be precision cut from 1/16-inch thick exterior grade, solid color, matte finish, modified acrylic material chemically welded using an acrylic solvent to the sign panel surface.
 2. Backer Plate: Manufacturers standard opaque acrylic, 1/16 inch thick.

3. Enamel Coating: Sub-surface industrial grade enamel coating shall be applied to second surface between lamination resulting in no exposed coated surfaces.
 4. Panels shall be laminated using a high bond adhesive under high pressure along the entire perimeter of panel.
 5. Rout panel edges to a smooth finish.
 6. Braille graphics shall have optically correct raster balls fused 0.015 inch into the sign face.
- D. Quantities: As shown on drawings and as required by ICC A117.1.
1. Contractor shall include in his proposal three additional interior way-finding signs, 12-inches wide by 18-inches high. Additional signs shall be installed where directed by the Architect.
- E. Additional Blank Panels: Where acrylic panel signs are required to be located on glass sidelights per IBC 2009, provide additional blank 1/8-inch thick acrylic panels in same size and color as each sign. Align and mount blank panel on glass face opposite the sign to conceal the back of the acrylic panel sign.
- F. Signs with Changeable Message Capability: Fabricate signs where indicated to allow insertion of changeable messages as follows:
1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner.
 - a. See Drawings for additional information.
- G. Locations: Coordinate locations and installation of all signage with the Architect.

2.4 MATERIALS

- A. Acrylic Sheet: ASTM D 4802, Category A-1 (Cell-Cast Sheet), Type UVF (UV absorbing).
- B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick; with adhesive on both sides.
- C. Construction Adhesive: As recommended by the manufacturer and approved by the Architect.

2.5 FINISHES

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate signs and accessories where shown or scheduled or as directed by the Architect, using mounting methods of types described and complying with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Acrylic Panel Signs: Mount all acrylic panel signage using concealed fasteners consisting of double sided tape and construction panel adhesive on backing. Apply (2) separate beads of sealant around the perimeter of the sign except at locations providing access to removable insert slots. All signage locations shall be in compliance with the ADA and as directed by the Architect.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturers' written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 105113 – METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Standard metal lockers.
- B. Related Requirements:
 - 1. Section 06100 “Rough Carpentry” for concealed furring, blocking, and shims required for installing metal lockers.

1.3 SUBMITTALS

- A. Product Data: For each type of metal locker.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: Manufacturer’s color charts showing the full range of colors available.
- D. Sample Warranty: For special warranty.
- E. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
1. Where new metal lockers are installed, five percent shall comply with accessibility requirements indicated.
 2. Verify final number and locations of accessible lockers with Architect.

2.2 MANUFACTURERS

- A. Basis of Design Products: Subject to compliance with requirements, provide product styles manufactured by Penco Products, Inc. as follows:
 - 1. Standard Lockers: Guardian Lockers with Medallion option.
- B. The following manufacturers will be acceptable when complying with all requirements of the Contract Documents as determined by the Architect.
 - 1. Lyon LLC.
 - 2. List Industries, Inc.
 - 3. Republic Storage Systems, LLC.

2.3 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS) Type B, suitable for exposed applications.

2.4 STANDARD METAL LOCKERS

- A. Locker Arrangement and Size:
 - 1. Double-Tier Units: 15” w. by 15” d. by 72” overall height.
- B. Body: Fabricate back and sides of minimum 24-gage steel, with double-flanged connections extending full height. Form top and bottom of not less than 24-gage steel, with flanged edges.
- C. Frames: Channel formed; fabricated from 0.0528-inch thick, cold-rolled steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
- D. Doors: One-piece, minimum 16-gage sheet steel, flanged at all edges, constructed to prevent springing when opening or closing. Fabricate to swing 180 degrees.
 - 1. Sound-Dampening Panels: Manufacturer’s standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
 - 2. Door Style: Flush with no exposed louvers.
 - a. Ventilation: Ventilation shall be facilitated by airflow slots located in the top and bottom flange of the door.

3. Hinges: Steel, full-loop, 5-knuckle, tight pin. Weld to inside of frame and secure to door with not fewer than two factory-installed fasteners that are completely concealed and tamperproof when door is closed.
 - a. Provide at least three hinges for each door more than 42 inches high and at least two hinges for each door 42 inches high or less.
- E. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking devices do not protrude beyond face of door; pry resistant.
 1. Single-Point Latching: Nonmoving latch hook with steel padlock hoop that projects through recessed cup and is finished to match metal locker body.
- F. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
- G. Hooks: Manufacturer's standard ball-pointed hooks, aluminum or steel; zinc plated.
- H. Legs: 6 inches high; formed by extending vertical frame members, or fabricated from 0.075-inch nominal-thickness steel sheet; welded to bottom of locker.
 1. Provide for single-tier units in Changing Room D101 only.
 2. Double-tier units in Automotive Technology B110 shall be installed on existing concrete base.
- I. Continuous Zee Base: Fabricated from, manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet.
 1. Height: 6 inches.
- J. Continuous Sloping Tops: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.
- K. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.
- L. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of non-recessed metal lockers; finished to match lockers.
- M. Finish: Manufacturer's standard antimicrobial paint finish.
 1. Color: As selected by Architect from manufacturer's full range.

2.5 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
 2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
- C. Equipment: Provide each locker with an identification plate and the following equipment:
1. Single and Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- D. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site.
- E. Accessible Lockers: Fabricate as follows:
1. Locate bottom shelf no lower than 15 inches above the floor.
 2. Where hooks, or additional shelves are provided, locate no higher than 48 inches above the floor.
 3. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist.
- F. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.
- G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
- H. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.
- I. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- J. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

2.6 ACCESSORIES

- A. Fasteners: Cadmium, zinc, or nickel-plated steel; exposed bolt heads, slotless type; self-locking nuts or lock washers for nuts on moving parts.

- B. Anchors: Material, type and size required for secure anchorage to each substrate.
 - 1. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.7 STEEL SHEET FINISHES

- A. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.
 - 1. Color: Provide locker units in color selected by Architect from the manufacturer's standard range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

3.2 INSTALLATION

- A. Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent avoid metal distortion.
- B. Knocked-Down Lockers: Assemble with standard fasteners, with no exposed fasteners no door faces or face frames.
- C. Equipment:
 - 1. Attach hooks with at least two fasteners.
 - 2. Attach door locks on doors using security-type fasteners.
 - 3. Identification Plates: Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach recess trim to recessed metal lockers with concealed clips.

2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on drawings.
3. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of non-recessed metal lockers.

3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices are operating properly.

3.4 PROTECTION

- A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch-up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Sleeves.
 - 4. Grout.
 - 5. HVAC demolition.
 - 6. Equipment installation requirements common to equipment sections.
 - 7. Painting and finishing.
 - 8. Supports and anchorages.
 - 9. Fire Stopping

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. CPVC: Chlorinated polyvinyl chloride plastic.
 - 2. PE: Polyethylene plastic.
 - 3. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Dielectric fittings.
 - 2. Mechanical sleeve seals.
 - 3. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- F. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.

- b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
- 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 4. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Sleeves are not required for core-drilled holes.
- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-

iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- P. Verify final equipment locations for roughing-in.
- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.

- C. Avoid air entrapment during placement of grout.
- D. Place grout, completely filling equipment bases.
- E. Place grout on concrete bases and provide smooth bearing surface for equipment.
- F. Place grout around anchors.

END OF SECTION 230500

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT 230513 - 1

- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT 230513 - 2

- 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 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Grout.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, with plain ends.
- B. Galvanized Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- C. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-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 Division 07 Section "Joint Sealants."
- D. Fire-Barrier 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 Division 07 Section "Penetration Firestopping."

3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 8: Galvanized-steel pipe sleeves.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve.
 - 2. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 8: Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 8: Galvanized-steel-pipe sleeves.
 - 4. Interior Masonry Partitions:

- a. Piping Smaller Than NPS 8: Steel-pipe sleeves.

END OF SECTION 230517

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.

1.3 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, partitions, and ceilings within finished spaces.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

3.2 FIELD QUALITY CONTROL

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

END OF SECTION 230518

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Thermometers.
 - 2. Gages.
 - 3. Test plugs.

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Terrice, H. O. Co.
 - 2. Weiss Instruments, Inc.
 - 3. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: Die-cast aluminum, 7 inches long.
- C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.

- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 THERMOWELLS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Terrice, H. O. Co.
 - 2. Weiss Instruments, Inc.
 - 3. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Manufacturers: Same as manufacturer of thermometer being used.
- C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.3 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Terrice, H. O. Co.
 - 2. Weiss Instruments, Inc.
 - 3. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - 6. Pointer: Red metal.
 - 7. Window: Glass.
 - 8. Ring: Metal.
 - 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.

10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.4 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Sisco Manufacturing Co.
3. Trerice, H. O. Co.
4. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

E. Test Kit: Furnish one test kit(s) containing one pressure gage and adaptor, one thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F.
3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
4. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install liquid-in-glass thermometers in the following locations:
 - 1. Inlet and outlet of each hydronic coil.

3.2 GAGE APPLICATIONS

- A. Install dry-case-type pressure gages for inlet and outlet of each hydronic coil

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install test plugs in tees in piping.

3.4 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 230519

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Bronze ball valves.
 2. Iron, single-flange butterfly valves.
 3. Iron, grooved-end butterfly valves.
 4. Bronze swing check valves.
 5. Iron, center-guided check valves.
 6. Bronze globe valves.
 7. Lubricated plug valves.
- B. Related Sections:
1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
 2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

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.

1.4 SUBMITTALS

- A. Product Data: For each type of valve 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 B31.9 for building services piping valves.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - g. Tyco Fire Products LP; Grinnell Mechanical Products.
 - h. Victaulic Company.

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. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC 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.
- D. Valve Actuator Types:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
 - 3. Wrench: For plug valves with square heads.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. 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.
 - 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 - 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- or Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:
 - 1. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 150 psig.

- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nickel-plated ductile iron.

2.4 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

- 1. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 175 psig.
 - c. Body Material: Coated, ductile iron.
 - d. Stem: Two-piece stainless steel.
 - e. Disc: Coated, ductile iron.
 - f. Seal: EPDM.

2.5 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:

- 1. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

2.6 IRON, CENTER-GUIDED CHECK VALVES

A. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

- 1. Description:
 - a. Standard: MSS SP-125.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 250 psig.
 - d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - e. Style: Compact wafer.
 - f. Seat: EPDM.

2.7 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: PTFE or TFE.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

2.8 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Description:
 - a. Standard: MSS SP-78, Type II.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - e. Pattern: Regular or short.
 - f. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Description:
 - a. Standard: MSS SP-78, Type II.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - e. Pattern: Regular or short.
 - f. Plug: Cast iron or bronze with sealant groove.

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 valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- 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 check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.

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.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly valves.
 - 2. Throttling Service except Steam: Globe valves.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger: Iron check valves with spring or iron, center-guided, resilient-seat check valves.
- 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.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

3.5 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two or Three piece, full port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Globe Valves: Class 150, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 8: 150 CWP, EPDM seat, ductile-iron disc.
3. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.
4. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.
5. Iron, Center-Guided Check Valves: Class 150, compact-wafer globe, metal resilient seat.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
1. Steel pipe hangers and supports.
 2. Metal framing systems.
 3. Thermal-hanger shield inserts.
 4. Fastener systems.
- B. Related Sections include the following:
1. Division 23 Section " Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
 2. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

- A. Product Data: For the following:
1. Steel pipe hangers and supports.
 2. Thermal-hanger shield inserts.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." AWS D1.3, "Structural Welding Code--Sheet Steel." And ASME Boiler and Pressure Vessel Code: Section IX.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Carpenter & Paterson, Inc.
 - 3. National Pipe Hanger Corporation.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Thomas & Betts Corporation.
 - 3. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. Pipe Shields, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.

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- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.
- 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. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. 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.

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2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 4, 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 4, 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.
- G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches 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.
- H. 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. C-Clamps (MSS Type 23): For structural shapes.
 6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 8. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 9. 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.
- I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

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- L. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel 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 Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. 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.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- L. Insulated Piping: Comply with the following:
 - 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 according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

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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.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 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 smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications.
- 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 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 contours of welded surfaces match adjacent contours.

3.5 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.

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT 230529 - 6

3.6 PAINTING

- A. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 230548 - VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Elastomeric hangers.
 - 2. Spring hangers
 - 3. Custom Roof Curbs for Rooftop Air Handling Units and Make-up Air Units.

1.3 DEFINITIONS

- A. IBC: International Building Code.

1.4 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 90 mph
 - 2. Building Classification Category: B
 - 3. Minimum 25 lb/sq. ft. multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of component used.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing

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laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. Kinetics Noise Control.
 - 3. Mason Industries.
 - 4. Vibration Eliminator Co., Inc.
 - 5. Vibration Mountings & Controls, Inc.
- B. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- C. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
 - 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - 7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 CUSTOM ROOF CURBS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. Isolation Technology, Inc.

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3. Kinetics Noise Control.
 4. Mason Industries.
 5. Pate
 6. Thybar Corporation.
 7. Vibration Eliminator Co., Inc.
 8. Vibration Mountings & Controls, Inc.
- B. General Requirements: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand wind forces.
- C. Support Assembly: Welded structural tube steel frame to provide continuous support for equipment and shall be designed to support unit and resist wind forces. Frame shall include structural tube steel stanchions at uniform spacing designed for field welding to roof framing structural steel; stanchions shall be capable of being field cut to length.
- D. Perimeter Curb: Full perimeter 12 gauge galvanized steel with wood nailer for attaching roof materials. Curb shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly. Curb shall be designed to accommodate existing roof slope.

2.3 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
1. Powder coating on springs and housings.
 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 3. Baked enamel or powder coat for metal components on isolators for interior use.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION-CONTROL DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

VIBRATION & SEISMIC CONTROLS FOR HVAC PIPING & EQUIP 230548 - 3

- B. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- C. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- E. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ADJUSTING

- A. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- B. Adjust active height of spring isolators.
- C. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.4 HVAC VIBRATION-CONTROL DEVICE SCHEDULE

- A. Supported Equipment: Rooftop Air Handling Units, Heat Recovery Units and Make-up Air Units
 - 1. Equipment Location: Roof
 - 2. Isolator Type: Custom Roof Curb with built-in vibration isolation springs, 1" Deflection.
- B. Supported Equipment: Indoor Air Handling Units

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1. Equipment Location: Mechanical Mezzanines
 2. Isolator Type, for units without factory installed internal isolation: Restrained vibration isolation springs, 1" Deflection.
 3. Isolator Type, for units with factory installed internal isolation: 1" thick neoprene/cork pad; continuous for entire length of unit base rails.
- C. Supported or Suspended Equipment: In-line Fans, In-Line Pumps, Unit Heaters, Cabinet Heaters, Gas Furnaces
1. Equipment Location: Suspended from roof or upper floor structure.
 2. Isolator Type: Spring Isolation Hangers with neoprene grommet, 1" Deflection
- D. Supported Equipment: Base Mounted Pumps
1. Equipment Location: Mechanical Rooms; mounted on concrete housekeeping pads.
 2. Isolator Type: 1" thick neoprene/cork pad; continuous for entire length of unit base rails.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. 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: 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-fourths the size of principal lettering.
 4. Fasteners: Stainless-steel rivets or self-tapping screws.
- B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 2. Letter Color: White.
 3. Background Color: Black.
 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-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus 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), plus 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, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- 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-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.

- H. 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. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 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 minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link 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.

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. 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.

B. Pipe Label Color Schedule:

1. Chilled-Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White
2. Heating Water Piping:
 - a. Background Color: Yellow
 - b. Letter Color: White.

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 HVAC terminal devices 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: 1-1/2 inches, round.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 TAB CONTRACTOR

- A. The Testing and Balancing Contractor (TAB Contractor) shall be retained directly by the Mechanical (HVAC) Contractor. The Mechanical (HVAC) Contractor shall work with the TAB contractor to correct any/all deficiencies observed by the TAB contractor.
1. The Mechanical (HVAC) Contractor shall coordinate all equipment start-up work with TAB Contractor.
 2. The Mechanical (HVAC) Contractor shall provide one fan/motor sheave change for each rooftop air handling unit; one fan per unit, one sheave change per fan/motor.
 3. The Mechanical (HVAC) Contractor shall review and verify the location of all balancing devices with the TAB Contractor.
 4. The Mechanical (HVAC) Contractor shall replace all air filters and clean and flush piping strainers prior to TAB work.
 5. The Mechanical (HVAC) Contractor shall verify the operability of automatic temperature controls prior to TAB work.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Testing and balancing services described in this section will be provided by an independent Testing and Balancing Contractor retained directly by the Mechanical Contractor. The Mechanical Contractor shall be responsible for coordinating his work, including the satisfactory operation of all mechanical equipment and controls, with the Testing and Balancing Contractor. Information included in this section is intended to assist the Mechanical Contractor with coordinating his work with the TAB Contractor.
- B. Section Includes:
1. Balancing Air Systems:
 - a. Variable-volume air systems including rooftop air handling units and indoor air handling units.
 - b. Constant volume exhaust air systems including industrial dust collection systems.
 2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems including hot water coils and terminal heating equipment.

1.4 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 entity engaged to perform TAB Work.

1.5 SUBMITTALS

- A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. 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 Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.
- B. TAB Specialists: Provide TAB services from any of the following TAB companies:
 - 1. Butler Balancing
 - 2. Air Balancing Engineers
 - 3. Optimum Performance Balancing
- C. TAB Conference: Meet with Engineer, Owner, and Mechanical (HVAC) Contractor on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.

 - D. Certify TAB field data reports and perform the following:
 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

 - E. TAB Report Forms: Use standard TAB contractor's forms approved by the Engineer.

 - F. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- 1.7 PROJECT CONDITIONS
- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- 1.8 COORDINATION
- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices 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 equipment performance data including fan curves.

- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

- G. Examine test reports specified in individual system and equipment Sections.

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- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- 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.

3.4 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' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air intakes and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check for proper sealing of air-handling-unit components.
- J. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 6. Obtain approval from the Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure airflow of submain and branch ducts.

- a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 3. Measure total system airflow. Adjust to within indicated airflow.
 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 1. Open all manual valves for maximum flow.
 2. Check flow-control valves for specified sequence of operation, and set at indicated flow.
 3. Set system controls so automatic valves are wide open to heat exchangers.
 4. Check air vents for a forceful liquid flow exiting from vents when manually operated.
- D. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- E. Set calibrated balancing valves, if installed, at calculated pre-settings.
- F. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- G. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- H. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 3. Record settings and mark balancing devices.
- I. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals.

3.8 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.

3.9 PROCEDURES FOR BOILERS

- A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow for each boiler and primary pump.

3.10 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
1. Entering- and leaving-water temperature.
 2. Water flow rate.
 3. Water pressure drop.
 4. Dry-bulb temperature of entering and leaving air.
 5. Airflow.
 6. Air pressure drop.
- B. Measure, adjust, and record the following data for each electric heating coil:
1. Nameplate data.
 2. Airflow.
 3. Entering- and leaving-air temperature at full load.
 4. Voltage and amperage input of each phase at full load and at each incremental stage.
 5. Calculated kilowatt at full load.
 6. Fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each steam coil:
1. Dry-bulb temperature of entering and leaving air.
 2. Airflow.
 3. Air pressure drop.
 4. Inlet steam pressure.
- D. Measure, adjust, and record the following data for each refrigerant coil:
1. Dry-bulb temperature of entering and leaving air.
 2. Wet-bulb temperature of entering and leaving air.
 3. Airflow.
 4. Air pressure drop.
 5. Refrigerant suction pressure and temperature.

3.11 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.12 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 systems' balancing devices. Recommend changes and additions to systems' 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.

3.13 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.
- 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 contractor.
 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 and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.

- c. Fan drive settings including settings and percentage of maximum pitch diameter.
 - d. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Rooftop Unit and Air Handling Unit Test Reports: For packaged rooftop units and air-handling units with coils, 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 rpm.
 - 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); for each fan:
 - a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
- F. Fan Test Reports: For exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - 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 rpm.
 - 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 rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
 - G. 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 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 air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
 - H. Instrument Calibration Reports:
 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.14 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.

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e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by the Engineer and Owner.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of the Engineer and Owner.
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. 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.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

END OF SECTION 230593

SECTION 230700 - HVAC 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:

1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
2. Adhesives.
3. Mastics.
4. Sealants.
5. Factory-applied jackets.
6. Field-applied jackets.
7. Tapes.
8. Securements.

- B. Section includes insulating the following HVAC systems:

1. HVAC air duct systems
2. Heating hot-water piping
3. Chilled water piping and equipment
4. Air-conditioning condensate drain piping, indoors.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Qualification Data: For qualified Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and 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.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 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 C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; All-Service Duct Wrap.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.
- I. 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 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.
- J. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Knauf Insulation; Permawick Pipe Insulation.
 - b. Owens Corning; VaporWick Pipe Insulation.

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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; AeroSeal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 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 Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.

- e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); 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; Speedline Vinyl Adhesive.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 2.3 MASTICS
- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 - B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, 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, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
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.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
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.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 - a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 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.
- D. Metal Jacket:
 1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor or Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.

- c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - 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. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. 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 in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.

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.

2.8 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. 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.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

2.3 ACOUSTICAL DUCT LAGGING SYSTEMS

- A. High density vinyl noise barrier with a fibrous glass scrim reinforced aluminum file facing on one side. STC rating 29. Comply with ASTM E-84 surface burning characteristics.
- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Sound Seal, type B-10/QFA-3 with 1" thick quilted fiberglass decoupler.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch- 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 as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and 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 similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at 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.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. 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 Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Duct: Install insulation continuously through floor penetrations that are not fire rated. 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. Pipe: Install insulation continuously through floor penetrations.
 3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. 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.
 6. 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, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches 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 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- 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.
- B. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. 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.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

- 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 but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
 1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.
- E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches 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 overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 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 2 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.
- F. 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, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches 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 overcompress 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 1 edge and 1 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 2 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.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. 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.
- B. 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.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Do not field paint aluminum jackets.

3.10 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed air-conditioning supply air located in ceiling spaces.
 - 2. Indoor, exposed air-conditioning supply air and outside air located in mechanical rooms.
- B. Items Not Insulated:
 - 1. Factory-insulated flexible ducts.
 - 2. Factory-insulated plenums and casings.
 - 3. Flexible connectors.
 - 4. Vibration-control devices.
 - 5. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, supply-air air and outside air duct insulation shall be the following:
 - 1. Mineral-Fiber Blanket: 2.25 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Exposed (applicable to indoor air handling units in mechanical rooms) supply air and outside air duct insulation shall be the following:
 - 1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

3.12 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.

3.13 INDOOR PIPING INSULATION SCHEDULE

- A. Heating-Hot-Water Supply and Return, 200 Deg F and below:
 - 1. NPS 1-1/2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.
 - 2. NPS 2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.
- B. Chilled-Water Supply and Return, 60 Deg F and below:
 - 1. NPS 1-1/2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.
 - 2. NPS 2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

- C. Air-conditioning Condensate Drain, 60 Deg F and below:
 - 1. NPS 1-1/2 and Smaller: Insulation shall be the following:
 - a. Elastomeric, 1/2 inches thick.

3.17 INDOOR ACOUSTICAL DUCT LAGGING SCHEDULE

- A. Apply acoustical duct lagging materials to ductwork where indicated on the drawings. Acoustical lagging shall be in addition to thermal insulation.

END OF SECTION 230700

SECTION 230900 – BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control equipment and installation for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-furnished controls.
- B. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration and installation to alter and extend the existing building automation system (also identified as BMS, Building Management System, or DDC Direct Digital Control System For HVAC) including all necessary hardware and all operating and applications software as required for the complete performance of the Work, as shown on the Drawings, as specified herein.
- C. **The new BMS components shall integrate and communicate with the existing DDC controllers and network devices installed throughout the existing School. The BAS contractor shall provide all related communication hardware, software, wiring, and programming necessary to integrate with the existing BAS system.**
 - 1. **Prior to commencing any physical alterations to the existing BAS, conduct a comprehensive survey of existing networked devices and provide functional testing of existing command and communication. Where failed devices or communication is encountered, submit a summary report to the engineer.**
 - 2. **Identify and label control panels, controllers, and wiring intended to be removed throughout renovated spaces.**
- D. Related Sections:
 - 1. Section 230993 Sequences of Operation.
 - 2. Division 26 Section "Cables and Raceways"

1.2 DEFINITIONS

- A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.
- B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.
- C. BACnet Specific Definitions:
 - 1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data over and services over a network.

2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
 3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
 4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.
 5. PICS (Protocol Implementation Conformance Statement): Written document that identifies the particular options specified by BACnet that are implemented in a device.
- D. Binary: Two-state signal where a high signal level represents ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.
- E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: Network Controller, Programmable Application Controller, and Application-Specific Controller.
- F. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.
- G. COV: Changes of value.
- H. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.
- I. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems shall be capable of operating in a standalone mode using the last best available data.
- J. DOCSIS: Data-Over Cable Service Interface Specifications.
- K. E/P: Voltage to pneumatic.
- L. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.
- M. HLC: Heavy load conditions.
- N. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.
- O. I/P: Current to pneumatic.
- P. LAN: Local area network.

- Q. LNS: LonWorks Network Services.
- R. LON Specific Definitions:
1. FTT-10: Echelon Transmitter-Free Topology Transceiver.
 2. LonMark: Association comprising suppliers and installers of LonTalk products. Association provides guidelines for implementing LonTalk protocol to ensure interoperability through a standard or consistent implementation.
 3. LonTalk: An open standard protocol developed by the Echelon Corporation that uses a "Neuron Chip" for communication. LonTalk is a register trademark of Echelon.
 4. LonWorks: Network technology developed by Echelon.
 5. Node: Device that communicates using CEA-709.1-C protocol and that is connected to a CEA-709.1-C network.
 6. Node Address: The logical address of a node on the network, consisting of a Domain number, Subnet number, and Node number. "Node number" portion of an address is a number assigned to device during installation, is unique within a subnet, and is not a factory-set unique Node ID.
 7. Node ID: A unique 48-bit identifier assigned at factory to each CEA-709.1-C device. Sometimes called a "Neuron ID."
 8. Program ID: An identifier (number) stored in a device (usually EEPROM) that identifies node manufacturer, functionality of device (application and sequence), transceiver used, and intended device usage.
 9. Standard Configuration Property Type (SCPT): Pronounced "skip-it." A standard format type maintained by LonMark International for configuration properties.
 10. Standard Network Variable Type (SNVT): Pronounced "snivet." A standard format type maintained by LonMark used to define data information transmitted and received by individual nodes. "SNVT" is used in two ways. It is an acronym for "Standard Network Variable Type" and is often used to indicate a network variable itself (i.e., it can mean "a network variable of a standard network variable type").
 11. Subnet: Consists of a logical grouping of up to 127 nodes, where logical grouping is defined by node addressing. Each subnet is assigned a number, which is unique within a Domain. See "Node Address."
 12. TP/FT-10: Free Topology Twisted Pair network defined by CEA-709.3 and is most common media type for a CEA-709.1-C control network.
 13. TP/XF-1250: High-speed, 1.25-Mbps, twisted-pair, doubly terminated bus network defined by "LonMark Interoperability Guidelines" typically used only to connect multiple TP/FT-10 networks.
 14. User-Defined Configuration Property Type (UCPT): Pronounced "U-Keep-It." A Configuration Property format type that is defined by device manufacturer.
 15. User-Defined Network Variable Type (UNVT): Network variable format defined by device manufacturer. UNVTs create non-standard communications that other vendors' devices may not correctly interpret and may negatively impact system operation. UNVTs are not allowed.
- S. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- T. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.

- U. Modbus TCP/IP: An open protocol for exchange of process data.
- V. MS/TP: Master-slave/token-passing, IEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.
- W. MTBF: Mean time between failures.
- X. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.
- Y. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.
- Z. Peer to Peer: Networking architecture that treats all network stations as equal partners.
- AA. POT: Portable operator's terminal.
- BB. PUE: Performance usage effectiveness.
- CC. RAM: Random access memory.
- DD. RF: Radio frequency.
- EE. Router: Device connecting two or more networks at network layer.
- FF. Server: Computer used to maintain system configuration, historical and programming database.
- GG. TCP/IP: Transport control protocol/Internet protocol.
- HH. UPS: Uninterruptible power supply.
- II. USB: Universal Serial Bus.
- JJ. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.
- KK. VAV: Variable air volume.
- LL. WLED: White light emitting diode.

1.3 SYSTEM DESCRIPTION

- A. The Building Automation System (BAS) contractor shall furnish and install a networked system of HVAC controls. The contractor shall incorporating direct digital control (DDC) for central plant equipment, building ventilation equipment, supplemental heating and cooling equipment, and terminal units.
- B. At the completion of this project all DDC controllers in the high school shall communicate via BACnet protocol. System shall be capable of BACnet communication

according to ASHRAE standard ANSI/ASHRAE 135-2010 for interoperability with smart equipment and for the main IP communication trunk to the BAS Server.

1.4 WORK INCLUDED

- A. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer.
- B. Furnish a complete distributed direct digital control system in accordance with this specification section. This includes all system controllers, logic controllers, and all input/output devices. Items of work included are as follows:
 - 1. Provide a submittal that meets the requirements below for approval.
 - 2. Coordinate installation schedule with the mechanical contractor and general contractor.
 - 3. Provide installation of all panels and devices unless otherwise stated.
 - 4. Provide power for panels and control devices.
 - 5. Provide all low voltage control wiring for the DDC system.
 - 6. Provide miscellaneous control wiring for HVAC and related systems regardless of voltage.
 - 7. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.
 - 8. Participate in commissioning for all equipment that is integrated into the BAS
 - 9. Provide testing, demonstration and training as specified below.

1.5 SUBMITTALS

- A. Provide submittals for fast track items that need to be approved and released to meet the schedule of the project. Provide submissions for the following items separately:
 - 1. Valve schedule and cut sheets
 - 2. Factory mounting and wiring diagrams and cut sheets
 - 3. Thermostat and space sensors.
- B. Provide a complete submittal with all controls system information for approval before construction starts. Include the following:
 - 1. Schematic flow diagrams showing fans, coils, dampers, valves, and control devices.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
 - 3. Details of control panel faces, including sizes, controls, instruments, and labeling.
 - 4. Schedule of dampers and actuators including size, leakage, and flow characteristics.
 - 5. If dampers are furnished by other, submit a damper actuator schedule coordinating actuator sizes with the damper schedule.
 - 6. Schedule of valves including leakage and flow characteristics.
 - 7. Written description of the Sequence of Operations.

8. Network riser diagram showing wiring types, network protocols, locations of floor penetrations and number of control panels. Label control panels with network addresses. Show all routers, switches, hubs and repeaters.
 9. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.
 10. Starter and variable frequency drive wiring details of all automatically controlled motors.
 11. Reduced size floor plan drawings showing locations of control panels, thermostats and any devices mounted in occupied space.
 12. Color graphics indicating the following:
 - a. Itemized list of color graphic displays to be provided
 - b. For each display screen to be provided, a true color copy showing layout of pictures, graphics, and data displayed.
 - c. Intended operator access between related hierarchical display screens.
- C. Product Data: Include manufacturer's technical literature for each control device indicated, labeled with setting or adjustable range of control. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
- D. Wiring Diagrams: Detail the wiring of the control devices and the panels. Show point-to-point wiring from field devices to the control panel. Show point-to-point wiring of hardwired interlocks. Show a ladder diagram or schematic of wiring internal to the panels, including numbered terminals. Clearly designate wiring that is done at a factory, at a panel shop or in the field.
- E. Submit blank field check-out and commissioning test reports, customized for each panel or system, which will be filled out by the technician during start-up.

1.6 QUALITY ASSURANCE

A. Codes

1. Perform all wiring in accordance with Division 26, NEC, local codes and Owner's requirements.
2. Uniform Building Code (UBC)
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
4. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
5. All equipment shall be UL listed and approved and shall meet with all applicable NFPA standards, including UL 916 - PAZZX Energy Management Systems,
6. Provide UL 864 - UUKL Smoke Control, where controllers and networks are used for that purpose.
 - a. Provide written approvals and certifications after installation has been completed.

7. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
8. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

B. Qualifications

1. Installing contractor shall be in the business of installing and servicing DDC controls for mechanical systems, temperature and ventilation control, environmental control, lighting control, access and security controls, and energy automation as their primary business. Installer Qualifications: An experienced installer who is the authorized representative of the automatic control system manufacturer for both installation and maintenance of controls required for this Project.
 2. Engineering, drafting, programming, and graphics generation shall be performed by the local branch engineers and technicians directly employed by the Building Automation System Contractor.
 3. Supervision, checkout and commissioning of the system shall be by the local branch engineers and technicians directly employed by the Building Automation System Contractor. They shall perform commissioning and complete testing of the BAS system.
- C. The BAS contractor shall maintain a service organization consisting of factory trained service personnel and provide a list of ten (10) projects, similar in size and scope to this project, completed within the last five years.
- D. Final determination of compliance with these specifications shall rest solely with the Engineers and Owner who will require proof of prior satisfactory performance.

1.7 COORDINATION

- A. Coordinate location of thermostats, humidistats, panels, and other exposed control components with plans and room details before installation.
- B. Coordinate power for control units and operator workstation with electrical contractor.
- C. Coordinate equipment with provider of starters and drives to achieve compatibility with motor starter control coils and VFD control wiring.
- D. Coordinate scheduling with the mechanical contractor and general contractor. Submit a schedule for approval based upon the installation schedule of the mechanical equipment.
- E. Products Furnished but Not Installed Under This Section

1. Hydronic Piping:

- a. Control Valves
 - b. Temperature Sensor Wells and Sockets
 - c. Flow Switches
2. Sheetmetal accessories
- a. Dampers
 - b. Airflow Stations
- F. Products Integrated To but Not Furnished or Installed Under This Section
- 1. Existing DDC Controllers

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For DDC system to include in emergency, operation, and maintenance manuals.
- 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format.
 - b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
 - c. As-built versions of submittal Product Data.
 - d. Names, addresses, e-mail addresses, and 24-hour telephone numbers of Installer and service representatives for DDC system and products.
 - e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
 - f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 - g. Engineering, installation, and maintenance manuals that explain how to:
 - 1) Design and install new points, panels, and other hardware.
 - 2) Perform preventive maintenance and calibration.
 - 3) Debug hardware problems.
 - 4) Repair or replace hardware.
 - h. Documentation of all programs created using custom programming language including set points, tuning parameters, and object database.
 - i. Backup copy of graphic files, programs, and database on electronic media such as DVDs.
 - j. List of recommended spare parts with part numbers and suppliers.
 - k. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
 - l. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.

- m. Licenses, guarantees, and warranty documents.
- n. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
- o. Owner training materials.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials and parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish quantity indicated of matching product(s) in Project inventory for each unique size and type of following:
 - 1. Programmable Application Controller: One.
 - 2. Application-Specific Controller: One.
 - 3. Room Temperature Sensor and Transmitter: Six.
 - 4. Combination On-Off Status Sensor and On-Off Relay: Six.
 - 5. Transformer: Four

1.10 WARRANTY

- A. Conform to the warranty requirement of the Contract Documents, General Requirements and this section or a minimum of 12 months. This warranty shall apply equally to both hardware and software.
- B. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system demonstration.
- C. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.

PART 2 - PRODUCTS AND INSTALLERS

2.1 ACCEPTABLE MANUFACTURERS AND INSTALLERS

- A. Provide a Building Automation System produced by the following:
 - 1. **Honeywell**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

3.2 INSTALLATION

- A. Install controls so that adjustments and calibrations can be readily made. Controls are to be installed by the control equipment manufacturer.
- B. Unless otherwise noted, install wall mounted thermostats and humidistat 60" above the floor measured to the center line of the instrument, or as otherwise directed by the Architect.
- C. Install averaging elements in ducts and plenums in horizontal crossing or zigzag pattern.
- D. Install damper motors on outside of duct in protected areas, not in locations exposed to outdoor temperatures.
- E. Furnish hydronic instrument wells, valves, and other accessories to the mechanical contractor for installation.
- F. Furnish automatic dampers to mechanical contractor for installation.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. BAS manufacturer shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All wiring shall be provided in accordance with all local and national codes and as described below:
 - 1. All wiring associated with the installation will be the responsibility of this Contractor, unless otherwise directed herein. The term "wiring" is construed to include furnishing of wire, conduit, miscellaneous material and labor as required, to install a total working system.
 - 2. All low voltage (30V and below) wiring above accessible, concealed and dry locations may be run in plenum-rated cable without conduit (must be independently supported every 5 feet with bridle rings or other method approved by the consulting engineer). All low voltage wiring in mechanical spaces or electric/telephone closets must be run in electric metallic tubing (EMT), 3/4-inch or greater up to a height of 8 feet AFF with plenum cable above that. All indoor wiring 30vac or greater shall be run in EMT conduit. All outdoor wiring shall be run in rigid metallic conduit. Seal tight may be used within 6 feet of the final connection to the device or panel.
 - 3. This contractor shall be responsible for power that is not shown on the electrical drawings, to controls furnished by this contractor.

4. Wiring for controls furnished by others:
 - a. Provide control wiring for HVAC controls furnished by others. Wiring may include, but not limited to, the following items:
 - 1) Thermostats
 - 2) Interlock wiring between split system AC units and their associated condensing unit

B. RS485 Cabling

1. RS485 cabling shall be used for BACnet MS/TP networks.
2. RS485 shall use low capacitance, 20-24 gauge, twisted shielded pair.
3. The shields shall be tied together at each device.

3.4 START-UP AND COMMISSIONING

- A. When installation of the system is complete, calibrate equipment and verify transmission media before system is placed on-line. All testing, calibrating, adjusting, and final field tests shall be completed by the BAS contractor.
- B. Perform a two-phase commissioning procedure consisting of field I/O calibration and overall system sequence of operation commissioning. Document that each point was verified and operating correctly on commissioning sheets, which shall be submitted prior to acceptance testing. The commissioning must be coordinated with the owner and construction manager to ensure systems are available when needed.

3.5 DDC SYSTEM VALIDATION TESTS

- A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.
- B. After approval of Test Plan, execute all tests and procedures indicated in plan.
- C. After testing is complete, submit completed test checklist.
- D. Pretest Checklist: Submit the following list with items checked off once verified:
 1. Detailed explanation for any items that are not completed or verified.
 2. Required mechanical installation work is successfully completed and HVAC equipment is working correctly.
 3. HVAC equipment motors operate below full-load amperage ratings.
 4. Required DDC system components, wiring, and accessories are installed.
 5. Installed DDC system architecture matches approved Drawings.
 6. Control electric power circuits operate at proper voltage and are free from faults.
 7. Required surge protection is installed.
 8. DDC system network communications function properly, including uploading and downloading programming changes.
 9. Using BACnet protocol analyzer, verify that communications are error free.
 10. Each controller's programming is backed up.
 11. Equipment, products, tubing, wiring cable, and conduits are properly labeled.
 12. All I/O points are programmed into controllers.

13. Testing, adjusting, and balancing work affecting controls is complete.
14. Dampers and actuators zero and span adjustments are set properly.
15. Each control damper and actuator goes to failed position on loss of power.
16. Valves and actuators zero and span adjustments are set properly.
17. Each control valve and actuator goes to failed position on loss of power.
18. Meter, sensor and transmitter readings are accurate and calibrated.
19. Control loops are tuned for smooth and stable operation.
20. View trend data where applicable.
21. Each controller works properly in standalone mode.
22. Safety controls and devices function properly.
23. Interfaces with fire-alarm system function properly.
24. Electrical interlocks function properly.
25. Operator workstations and other interfaces are delivered, all system and database software is installed, and graphic are created.
26. Record Drawings are completed.

E. Test Plan:

1. Prepare and submit a validation test plan including test procedures for performance validation tests.
2. Test plan shall address all specified functions of DDC system and sequences of operation.
3. Explain detailed actions and expected results to demonstrate compliance with requirements indicated.
4. Explain method for simulating necessary conditions of operation used to demonstrate performance.
5. Include a test checklist to be used to check and initial that each test has been successfully completed.
6. Submit test plan documentation 10 business days before start of tests.

F. Validation Test:

1. Verify operating performance of each I/O point in DDC system.
 - a. Verify analog I/O points at operating value.
 - b. Make adjustments to out-of-tolerance I/O points.
 - 1) Identify I/O points for future reference.
 - 2) Simulate abnormal conditions to demonstrate proper function of safety devices.
 - 3) Replace instruments and controllers that cannot maintain performance indicated after adjustments.
2. Simulate conditions to demonstrate proper sequence of control.
3. Readjust settings to design values and observe ability of DDC system to establish desired conditions.
4. After 24 Hours following Initial Validation Test:
 - a. Re-check I/O points that required corrections during initial test.
 - b. Identify I/O points that still require additional correction and make corrections necessary to achieve desired results.

5. After 24 Hours of Second Validation Test:
 - a. Re-check I/O points that required corrections during second test.
 - b. Continue validation testing until I/O point is normal on two consecutive tests.
6. Completely check out, calibrate, and test all connected hardware and software to ensure that DDC system performs according to requirements indicated.
7. After validation testing is complete, prepare and submit a report indicating all I/O points that required correction and how many validation re-tests it took to pass. Identify adjustments made for each test and indicate instruments that were replaced.

3.6 FINAL REVIEW

- A. Submit written request to Architect and Construction Manager when DDC system is ready for final review. Written request shall state the following:
 1. DDC system has been thoroughly inspected for compliance with contract documents and found to be in full compliance.
 2. DDC system has been calibrated, adjusted and tested and found to comply with requirements of operational stability, accuracy, speed and other performance requirements indicated.
 3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
 4. DDC system is complete and ready for final review.
- B. Review by Architect and Construction Manager shall be made after receipt of written request. A field report shall be issued to document observations and deficiencies.
- C. Take prompt action to remedy deficiencies indicated in field report and submit a second written request when all deficiencies have been corrected. Repeat process until no deficiencies are reported.
- D. Should more than two reviews be required, DDC system manufacturer and Installer shall compensate entity performing review for total costs, labor and expenses, associated with third and subsequent reviews. Estimated cost of each review shall be submitted and approved by DDC system manufacturer and Installer before making the review.
- E. Prepare and submit closeout submittals when no deficiencies are reported.
- F. A part of DDC system final review shall include a demonstration to parties participating in final review.
 1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
 2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
 3. Demonstration shall include, but not be limited to, the following:
 - a. Accuracy and calibration of 20 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying

performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.

- b. HVAC equipment and system hardwired and software safeties and life-safety functions are operating according to sequence of operation. Up to 20 I/O points shall be randomly selected by reviewers. Additional I/O points may be selected by reviewers to discover problems with operation.
- c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.
- d. Operation of randomly selected dampers and valves in normal-on, normal-off and failed positions.
- e. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
- f. Trends, summaries, logs and reports set-up for Project.
- g. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
- h. Software's ability to communicate with controllers, operator workstations, uploading and downloading of control programs.
- i. Software's ability to edit control programs off-line.
- j. Data entry to show Project-specific customizing capability including parameter changes.
- k. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
- l. Execution of digital and analog commands in graphic mode.
- m. Spreadsheet and curve plot software and its integration with database.
- n. Online user guide and help functions.
- o. Multitasking by showing different operations occurring simultaneously on four quadrants of split screen.
- p. System speed of response compared to requirements indicated.
- q. For Each Network and Programmable Application Controller:
 - 1) Memory: Programmed data, parameters, trend and alarm history collected during normal operation is not lost during power failure.
 - 2) Operator Interface: Ability to connect directly to each type of digital controller with a portable workstation and mobile device. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.
 - 3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
 - 4) Electric Power: Ability to disconnect any controller safely from its power source.
 - 5) Wiring Labels: Match control drawings.
 - 6) Network Communication: Ability to locate a controller's location on network and communication architecture matches Shop Drawings.

- 7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators, and devices.
- r. For Each Operator Workstation:
- 1) I/O points lists agree with naming conventions.
 - 2) Graphics are complete.
 - 3) UPS unit, if applicable, operates.
- s. Communications and Interoperability: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. Use ASHRAE 135 protocol analyzer to help identify devices, view network traffic, and verify interoperability. Requirements must be met even if only one manufacturer's equipment is installed.
- 1) Data Presentation: On each operator workstation, demonstrate graphic display capabilities.
 - 2) Reading of Any Property: Demonstrate ability to read and display any used readable object property of any device on network.
 - 3) Set Point and Parameter Modifications: Show ability to modify set points and tuning parameters indicated.
 - 4) Peer-to-Peer Data Exchange: Network devices are installed and configured to perform without need for operator intervention to implement Project sequence of operation and to share global data.
 - 5) Alarm and Event Management: Alarms and events are installed and prioritized according to Owner. Demonstrate that time delays and other logic are set up to avoid nuisance tripping. Show that operators with sufficient privileges are permitted.
 - 6) Schedule Lists: Schedules are configured for start and stop, mode change, occupant overrides, and night setback as defined in sequence of operations.
 - 7) Schedule Display and Modification: Ability to display any schedule with start and stop times for calendar year. Show that all calendar entries and schedules are modifiable from any connected operator workstation by an operator with sufficient privilege.
 - 8) Archival Storage of Data: Data archiving is handled by operator workstation and server and local trend archiving and display is accomplished.
 - 9) Modification of Trend Log Object Parameters: Operator with sufficient privilege can change logged data points, sampling rate, and trend duration.
 - 10) Device and Network Management:
 - a) Display of network device status.
 - b) Display of BACnet Object Information.
 - c) Silencing devices transmitting erroneous data.
 - d) Time synchronization.
 - e) Remote device re-initialization.
 - f) Backup and restore network device programming and master database(s).
 - g) Configuration management of routers.

3.7 PROJECT RECORD DOCUMENTS

- A. Operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. As a minimum include the following:
1. Complete as-built installation drawings for each building system.
 2. Parts list with manufacturer's catalog numbers and ordering information.
 3. Manufacturer's catalog literature for each piece of equipment.
 4. Sequence of operation for automatic and manual operating modes for all building systems.

3.6 TRAINING

- A. During System commissioning and at such time as acceptable performance of the Building Automation System hardware and software has been established, the BAS contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent building automation contractor representative familiar with the Building Automation System's software, hardware and accessories.

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. Related Sections include the following:
 - 1. Division 203900 "Building Automation System" for control system general requirements, installation, execution, and extended warranties.

1.3 DEFINITIONS

- A. DDC: Direct Digital Control.
- B. BAS: Building Automation System (aka, BMS)
- C. BMS: Building Management System (aka, BAS)
- D. FMS: Facility Management System (aka, BMS)
- E. VAV: Variable air volume.

1.4 HVAC SEQUENCES OF OPERATION – BASIC SCOPE

- A. Alter and extend the existing Building Automation System (BAS) for control, monitoring, and alarming of the proposed HVAC equipment and systems as depicted on the drawings and as specified herein.
 - 1. The existing BAS control system shall remain with exception to existing controls serving HVAC equipment designated to be removed or relocated.
 - a. Prior to commencing demolition and removal of existing HVAC equipment, conduct a site survey with the Mechanical Contractor to identify existing controls which are intended to remain in place upon project completion. Label and mark all devices, wiring, and related components which are intended to remain. Remove all un-used or un-needed components; remove all obsolete components. Do not

abandon un-used control components or wiring in place. Remove obsolete wiring back to mains or local sources. Cut and terminate wiring that is buried in wall or ceiling construction that is not accessible for complete removal.

- b. Provide temporary protection for all existing control equipment and wiring intended to remain.
2. Provide new controls for the following types of equipment:
- a. Rooftop heating and ventilating air-handling units (2-pipe).
 - b. Rooftop heating, ventilating, and air-conditioning (4-pipe).
 - c. Indoor heating, ventilating, and air-conditioning (4-pipe).
 - d. VAV air terminal units equipped with hydronic heating coils.
 - e. Terminal hydronic heat
 - f. Exhaust fans including variable frequency drives
 - g. Industrial dust collectors (for field wiring of factory furnished panels)
 - h. Intake and relief air hoods and dampers.
- B. The Electrical Contractor will provide power circuits to HVAC equipment depicted on the drawings. Control Contractor is responsible for extending power wiring from the designated panels to his control devices.
- C. Coordinate the final location of controls, dampers, sensors, immersion wells, and similar devices with the Mechanical Contractor.

1.5 GENERAL

- A. Space Sensors: For space temperature sensors located in offices, meeting rooms, classrooms, and similar spaces, provide wall mounted sensors with manual heat/cool adjustment slide and manual pushbutton unoccupied override switch; match the existing space temperature sensors. Provide locking covers for sensors located in tech-ed shops, storage rooms, corridors, similar areas subject to potential abuse.
- B. Whenever any zone is in the occupied mode, the respective units shall be energized to run continuously and outside air dampers shall open to minimum position; the units shall operate occupied setpoint temperature and humidity conditions. Exhaust fans (where noted on the schedules as ATC or Clock) within the appropriate zones shall be energized.
- C. Provide manual over-ride push buttons on all space temperature sensors in administrative office areas to index the respective units to the occupied mode for a programmable time period of 1 to 5 hours:

1.6 4-PIPE ROOFTOP AIR HANDLING UNITS (RTU-101)

- A. The air handling units consist of: a mixed air section with economizer dampers, pre-filters, face and by-pass dampers (applicable to heating and cooling coils), hot water heating coil, chilled water cooling coil, and a variable speed supply fan. The units shall be DDC controlled using electronic valve and damper actuation. Provide 2-way modulating chilled water and hot water control valves.

- B. The units shall be scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system shall enter the Warm-Up mode when the space temperature is below set point or the Cool-Down mode when the space temperature is above set point. The system stays in the Warm-Up or Cool-Down mode until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 55 degrees F and Night Cooling is available when the space temperature rises above 90 degrees F. The latest start time is the scheduled occupancy for the space.
- C. The units shall utilize discharge air setpoint control and shall operate in Warm-Up, Cool-Down, Occupied, Unoccupied, Night Heating, Night Cooling, and Safety modes as follows (All suggested set points and settings are adjustable.):
1. Discharge Air Temperature Control: Re-set supply air temperatures setpoint in response to the VAV zone requiring the most cooling: re-set temperature downwards as the vav box approaches 90% open, re-set temperature upwards as the vav box closes to 80% open. For single zone units, re-set supply air temperature setpoint in response to room heating or cooling demand.
 2. Warm-Up: The supply fan starts. The “economizer” damper shall position for 100% return air. For outdoor ambient temperatures below 45 deg F, the hot water heating coil control valve shall position fully open to the coil; face and by-pass dampers shall modulate to maintain the supply air temperature set point. For outdoor ambient temperatures above 45 deg F, face and by-pass dampers shall position fully open to the coil and the hot water heating coil control valve shall modulate to maintain the supply air temperature set point. The system is prevented from entering the Warm-Up mode more than once per day. The unit is prevented from entering the occupied mode until warm-up setpoint is achieved.
 3. Cool-Down: The supply fan starts. If outdoor air enthalpy is suitable for free cooling, the economizer damper modulates open to maintain the supply air temperature set point. If outside air is not suitable for free cooling, the outside air dampers shall close. If additional cooling is required, the chilled water cooling coil control valve shall position fully open to the coil; face and by-pass dampers shall modulate to maintain the supply air temperature set point. If time reaches the latest start time during the Cool-Down mode, the outdoor air damper opens to its minimum position or is controlled in economizer. The system is prevented from entering the Cool-Down mode more than once per day.
 4. Occupied Cooling: The supply fans starts or continues to run. Hot water heating coil control valve shall be closed to the coil. If outdoor air enthalpy is suitable for free cooling, the economizer dampers modulate open to maintain the supply air temperature set point. If additional cooling is required, chilled water cooling coil control valve shall position fully open to the coil; face and by-pass dampers shall modulate to maintain supply air setpoint. The economizer dampers shall ramp open slowly to minimize overshooting. If outside air is not suitable for free cooling, the outside air dampers shall close to minimum outdoor air position.
 5. Occupied Heating: The supply fan starts or continues to run. Chilled water cooling coil control valve shall be closed to the coil. Outside air damper opens to minimum. For

outdoor ambient temperatures below 45 deg F, the hot water heating coil control valve shall position fully open to the coil. Face and by-pass dampers shall modulate to maintain the supply air temperature set point. For outdoor ambient temperatures above 45 deg F, face and by-pass dampers shall position fully open to the coil and the hot water heating coil control valve shall modulate to maintain the supply air temperature set point.

6. Economizer (Outside Air) Damper Control: When the outside air enthalpy is less than return air enthalpy, the economizer shall be enabled. There will be a 1 BTU/LB dead band between changeovers. The “economizer” damper shall modulate to maintain the OA flow at setpoint. The OA flow setpoint shall remain at a minimum value as scheduled on the drawings when the economizer is disabled. When economizer is enabled, the setpoint shall be reset from the minimum to a maximum of 100% capacity to maintain the mixed air enthalpy at setpoint.
7. Unoccupied (Normal Off): The supply fan is off and the outside air dampers are closed. Whenever outdoor ambient temperatures fall below 35 deg F, all associated heating valves shall position open to the coils and chilled water cooling control valves shall position closed to the coil. Whenever outdoor ambient temperatures are above 65deg F, all heating control valves shall be closed to the heating coil and chilled water valves shall be open to the coil.
8. Night Heating: Whenever any zone falls below night setback temperature, the supply fan shall energize and the face and by-pass dampers shall modulate to maintain discharge air setpoint temperature. The supply fan shall de-energize when all zones are satisfied.
9. Night Cooling: Whenever any zone rises above night setup temperature, the supply fan shall energize. If outdoor air enthalpy is suitable for free cooling, the economizer damper modulates open to maintain the supply air temperature set point. If outside air is not suitable for free cooling, the outside air dampers shall close. If additional cooling is required, and the cooling coil control valve shall open to the coil and face and by-pass dampers shall modulate to maintain discharge air setpoint temperature.
10. Supply Fan Control: Provide a static pressure sensor installed in the supply air duct at least two-thirds of the way downstream of the supply fans and in the longest or most critical duct. The BMS shall maintain 1.0” WC (initial setup) in the common duct at the pressure sensor. The BMS shall optimize the Variable-Air-Volume (VAV) fan discharge static pressure setpoints. The BMS shall identify an appropriate duct static pressure model and dynamically reset the fan discharge static pressure setpoint in response to VAV box damper position. The controller shall modulate supply fan speed but shall not modulate below a fixed minimum setting as determined by the rooftop unit manufacturer to maintain adequate motor cooling.
11. Demand Control Ventilation: The return air CO2 level shall be monitored. When the unit is initially indexed at the start of the occupied mode the outside damper shall remain in full closed position until CO2 levels rise above 500PPM. Once CO2s setpoint is exceeded, the outside air damper shall be opened to minimum position.

D. Safeties:

1. Where indicated on the drawings, a duct mounted smoke detector located in the return air stream shall de-energize the unit upon activation and shall close the outside air dampers. Smoke detectors will be furnished by the Electrical Contractor and mounted in the ductwork by the HVAC Contractor. Control wiring, including control power source, to de-energize the unit shall be provided by the BMS Contractor.
 2. Provide a freeze-stat on the leaving airside of the hot water heating coil. De-energize the unit if coil leaving air temperature falls below 40 deg F. Indicate low limit trip and unit shut-down as an alarm on the BMS.
 3. Indicate a warning on the BMS if return air relative humidity rises above 70% RH.
 4. Indicate a warning on the BMS if space temperature falls below or rises above setpoint by more than 10 deg F.
 5. Provide a temperature sensor on the surface of each hydronic pipe (HWS, HWR, CWS, CWR) installed within the rooftop unit piping vestibule. Mount sensor beneath piping insulation and below coil connections. Indicate an alarm on the BMS if piping surface temperature falls below 40F (Note: Piping will be electrically heat traced by the Mechanical Contractor; coordinate sensor location to avoid influence from heat trace.)
 6. Provide a dirty filter alarm for each filter bank; indicate dirty filter warning on the BMS.
- K. Coordination of setpoints: Ensure that mixed-air, heating, and cooling controls have common inputs and do not overlap in function.
- L. Operator Station Display: Indicate the following on operator workstation display terminal:
1. System graphic.
 2. System on-off indication.
 3. System occupied/unoccupied mode indication.
 4. System occupancy schedule.
 5. System cooling or heating mode including warm-up, cool-down, night heating, and night cooling.
 6. Supply-fan-discharge static-pressure indication.
 7. Supply-fan-discharge static-pressure set point.
 8. Supply fan status.
 9. Dirty Filter indication.
 10. Discharge air-temperature indication.
 11. Discharge air-temperature set point.
 12. Cooling valve, % open
 13. Heating valve, % open
 14. Face and by-pass damper position.
 15. Outdoor-air-temperature indication.
 16. Outdoor air relative humidity indication.
 17. Outdoor air damper set point
 18. Outdoor air damper position.
 19. Return air temperature indication
 20. Return air relative humidity indication.
 21. Low discharge air temperature alarm
 22. Return air high relative humidity warning
 23. High or low space temperature, beyond 10 deg F tolerance, any zone.
 24. Heating coil freeze-stat trip.
 25. Pipe freeze alarm.

- 1.7 2-PIPE ROOFTOP AIR HANDLING UNIT (RTU-102)
- A. The air handling unit consists of: a mixed air section with economizer dampers, pre-filters, high efficiency filters, face and by-pass dampers, hot water heating coil, and a variable speed supply fan. The units shall be DDC controlled using electronic valve and damper actuation. Provide 2-way modulating hot water control valves.
 - B. The units shall be scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system shall enter the Warm-Up mode when the space temperature is below set point. The system stays in the Warm-Up mode until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 55 degrees F. The latest start time is the scheduled occupancy for the space.
 - C. The units shall utilize discharge air setpoint control and shall operate in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):
 - 1. Discharge Air Temperature Control: Re-set supply air temperature setpoint in response to room heating or cooling (economizer) demand.
 - 2. Warm-Up: The supply fan starts. The “economizer” damper shall position for 100% return air. For outdoor ambient temperatures below 45 deg F, the hot water heating coil control valve shall position fully open to the coil; face and by-pass dampers shall modulate to maintain the supply air temperature set point. For outdoor ambient temperatures above 45 deg F, face and by-pass dampers shall position fully open to the coil and the hot water heating coil control valve shall modulate to maintain the supply air temperature set point. The system is prevented from entering the Warm-Up mode more than once per day. The unit is prevented from entering the occupied mode until warm-up setpoint is achieved.
 - 3. Occupied Cooling: The supply fans starts or continues to run. Hot water heating coil control valve shall be closed to the coil. If outdoor air enthalpy is suitable for free cooling, the economizer dampers modulate open to maintain the supply air temperature set point. The economizer dampers shall ramp open slowly to minimize overshooting. If outside air is not suitable for free cooling, the outside air dampers shall close to minimum outdoor air position.
 - 4. Occupied Heating: The supply fan starts or continues to run. Chilled water cooling coil control valve shall be closed to the coil. Outside air damper opens to minimum. For outdoor ambient temperatures below 45 deg F, the hot water heating coil control valve shall position fully open to the coil. Face and by-pass dampers shall modulate to maintain the supply air temperature set point. For outdoor ambient temperatures above 45 deg F, face and by-pass dampers shall position fully open to the coil and the hot water heating coil control valve shall modulate to maintain the supply air temperature set point.
 - 5. Economizer (Outside Air) Damper Control: When the outside air temperature is less than return air temperature, the economizer shall be enabled. There will be a 1 deg F dead band between changeovers. The “economizer” damper shall modulate to maintain the

OA flow at setpoint. The OA flow setpoint shall remain at a minimum value as scheduled on the drawings when the economizer is disabled. When economizer is enabled, the setpoint shall be reset from the minimum to a maximum of 100% capacity to maintain the mixed air setpoint.

6. Unoccupied (Normal Off): The supply fan is off and the outside air dampers are closed. Whenever outdoor ambient temperatures fall below 35 deg F, all associated heating valves shall position open to the coils. Whenever outdoor ambient temperatures are above 65deg F, all heating control valves shall be closed to the heating coil.
7. Night Heating: Whenever the space temperature falls below night setback temperature, the supply fan shall energize and the face and by-pass dampers shall modulate to maintain discharge air setpoint temperature. The supply fan shall de-energize when the space is satisfied.
8. Supply Fan Control: Operate supply fan at a constant rate to deliver maximum specified airflow. Coordinate VFD programming with the TAB agent.
9. Make-Up Air Mode: Gradually open the outside air damper to 50% open whenever one downdraft cutting table exhaust fan is energized; open outside air damper to 100% when both fans are energized. Return damper to normal position when the exhaust fans are de-energized.

D. Safeties:

1. Where indicated on the drawings, a duct mounted smoke detector located in the return air stream shall de-energize the unit upon activation and shall close the outside air dampers. Smoke detectors will be furnished by the Electrical Contractor and mounted in the ductwork by the HVAC Contractor. Control wiring, including control power source, to de-energize the unit shall be provided by the BMS Contractor.
2. Provide a freeze stat on the leaving airside of the hot water heating coil. De-energize the unit if coil leaving air temperature falls below 40 deg F. Indicate low limit trip and unit shut-down as an alarm on the BMS.
3. Indicate a warning on the BMS if space temperature falls below or rises above setpoint by more than 10 deg F.
4. Provide a temperature sensor on the surface of each hydronic pipe (HWS, HWR) installed within the rooftop unit piping vestibule. Mount sensor beneath piping insulation and below coil connections. Indicate an alarm on the BMS if piping surface temperature falls below 40F (Note: Piping will be electrically heat traced by the Mechanical Contractor; coordinate sensor location to avoid influence from heat trace.)
5. Provide a dirty filter alarm for each filter bank; indicate dirty filter warning on the BMS.

K. Coordination of setpoints: Ensure that mixed-air, heating, and cooling controls have common inputs and do not overlap in function.

L. Operator Station Display: Indicate the following on operator workstation display terminal:

1. System graphic.
2. System on-off indication.

3. System occupied/unoccupied mode indication.
4. System occupancy schedule.
5. System cooling or heating mode including warm-up, night heating.
6. Supply fan status.
7. Dirty Filter indication.
8. Discharge air-temperature indication.
9. Discharge air-temperature set point.
10. Heating valve, % open
11. Face and by-pass damper position.
12. Outdoor-air-temperature indication.
13. Outdoor air relative humidity indication.
14. Outdoor air damper set point
15. Outdoor air damper position.
16. Return air temperature indication.
17. Low discharge air temperature alarm
18. High or low space temperature, beyond 10 deg F tolerance, any zone.
19. Heating coil freeze alarm
20. Pipe freeze alarm.

1.8 4-PIPE INDOOR AIR HANDLING UNITS (AHU-103)

- A. The air handling units consist of: a mixed air section with economizer dampers, pre-filters, hot water heating coil, chilled water cooling coil, and a variable speed supply fan. The units shall be DDC controlled using electronic valve and damper actuation. Provide 2-way modulating chilled water and hot water control valves unless otherwise indicated.
- B. The units shall be scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system shall enter the Warm-Up mode when the space temperature is below set point or the Cool-Down mode when the space temperature is above set point. The system stays in the Warm-Up or Cool-Down mode until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 55 degrees F and Night Cooling is available when the space temperature rises above 90 degrees F. The latest start time is the scheduled occupancy for the space.
- C. The units shall utilize discharge air setpoint control and shall operate in Warm-Up, Cool-Down, Occupied, Unoccupied, Night Heating, Night Cooling, and Safety modes as follows (All suggested set points and settings are adjustable.):
 1. Discharge Air Temperature Control: Re-set supply air temperatures setpoint in response to the VAV zone requiring the most cooling: re-set temperature downwards as the vav box approaches 90% open, re-set temperature upwards as the vav box closes to 80% open.
 2. Warm-Up: The supply fan starts. The “economizer” damper shall position for 100% return air. The hot water heating coil control valve shall modulate to maintain the supply air temperature set point. The system is prevented from entering the Warm-Up mode more than once per day. The unit is prevented from entering the occupied mode until warm-up setpoint is achieved.

3. Cool-Down: The supply fan starts. If outdoor air enthalpy is suitable for free cooling, the economizer damper modulates open to maintain the supply air temperature set point. If outside air is not suitable for free cooling, the outside air dampers shall close. If additional cooling is required, the chilled water cooling coil control valve shall modulate to maintain the supply air temperature set point. If time reaches the latest start time during the Cool-Down mode, the outdoor air damper opens to its minimum position or is controlled in economizer. The system is prevented from entering the Cool-Down mode more than once per day.
4. Occupied Cooling: The supply fans starts or continues to run. Hot water heating coil control valve shall be closed to the coil. If outdoor air enthalpy is suitable for free cooling, the economizer dampers modulate open to maintain the supply air temperature set point. If additional cooling is required, chilled water cooling coil control valve shall modulate to maintain supply air setpoint. The economizer dampers shall ramp open slowly to minimize overshooting. If outside air is not suitable for free cooling, the outside air dampers shall close to minimum outdoor air position.
5. Occupied Heating: The supply fan starts or continues to run. Chilled water cooling coil control valve shall be closed to the coil. Outside air damper opens to minimum. The hot water heating coil control valve shall modulate to maintain the supply air temperature set point.
6. Economizer (Outside Air) Damper Control: When the outside air enthalpy is less than return air enthalpy, the economizer shall be enabled. There will be a 1 BTU/LB dead band between changeovers. The "economizer" damper shall modulate to maintain the OA flow at setpoint. The OA flow setpoint shall remain at a minimum value as scheduled on the drawings when the economizer is disabled. When economizer is enabled, the setpoint shall be reset from the minimum to a maximum of 100% capacity to maintain the mixed air enthalpy at setpoint.
7. Unoccupied (Normal Off): The supply fan is off and the outside air dampers are closed. Whenever outdoor ambient temperatures fall below 35 deg F, all associated heating valves shall position open to the coils and chilled water cooling control valves shall position closed to the coil. Whenever outdoor ambient temperatures are above 65deg F, all heating control valves shall be closed to the heating coil and chilled water valves shall be open to the coil.
8. Night Heating: Whenever any zone falls below night setback temperature, the supply fan shall energize and the face and by-pass dampers shall modulate to maintain discharge air setpoint temperature. The supply fan shall de-energize when all zones are satisfied.
9. Night Cooling: Whenever any zone rises above night setup temperature, the supply fan shall energize. If outdoor air enthalpy is suitable for free cooling, the economizer damper modulates open to maintain the supply air temperature set point. If outside air is not suitable for free cooling, the outside air dampers shall close. If additional cooling is required, and the cooling coil control valve shall modulate to maintain discharge air setpoint temperature.

10. Supply Fan Control: Provide a static pressure sensor installed in the supply air duct at least two-thirds of the way downstream of the supply fans and in the longest or most critical duct. The BMS shall maintain 0.5" WC (initial setup) in the common duct at the pressure sensor. The BMS shall optimize the Variable-Air-Volume (VAV) fan discharge static pressure setpoints. The BMS shall identify an appropriate duct static pressure model and dynamically reset the fan discharge static pressure setpoint in response to VAV box damper position. The controller shall modulate supply fan speed but shall not modulate below a fixed minimum setting as determined by the rooftop unit manufacturer to maintain adequate motor cooling.
11. Demand Control Ventilation: The return air CO2 level shall be monitored. When the unit is initially indexed at the start of the occupied mode the outside damper shall remain in full closed position until CO2 levels rise above 500PPM. Once CO2s setpoint is exceeded, the outside air damper shall be opened to minimum position.

D. Safeties:

1. Where indicated on the drawings, a duct mounted smoke detector located in the return air stream shall de-energize the unit upon activation and shall close the outside air dampers. Smoke detectors will be furnished by the Electrical Contractor and mounted in the ductwork by the HVAC Contractor. Control wiring, including control power source, to de-energize the unit shall be provided by the BMS Contractor.
2. Provide a freezestat on the leaving airside of the hot water heating coil. De-energize the unit if coil leaving air temperature falls below 40 deg F. Indicate low limit trip and unit shut-down as an alarm on the BMS.
3. Indicate a warning on the BMS if return air relative humidity rises above 70% RH.
4. Indicate a warning on the BMS if space temperature falls below or rises above setpoint by more than 10 deg F.
5. Provide a dirty filter alarm for each filter bank; indicate dirty filter warning on the BMS.

K. Coordination of setpoints: Ensure that mixed-air, heating, and cooling controls have common inputs and do not overlap in function.

L. Operator Station Display: Indicate the following on operator workstation display terminal:

1. System graphic.
2. System on-off indication.
3. System occupied/unoccupied mode indication.
4. System occupancy schedule.
5. System cooling or heating mode including warm-up, cool-down, night heating, and night cooling.
6. Supply-fan-discharge static-pressure indication.
7. Supply-fan-discharge static-pressure set point.
8. Supply fan status.
9. Dirty Filter indication.
10. Discharge air-temperature indication.
11. Discharge air-temperature set point.
12. Cooling valve, % open
13. Heating valve, % open

14. Outdoor-air-temperature indication.
15. Outdoor air relative humidity indication.
16. Outdoor air damper set point
17. Outdoor air damper position.
18. Return air temperature indication
19. Return air relative humidity indication.
20. Heating coil freeze/STAT alarm
21. Return air high relative humidity warning
22. High or low space temperature, beyond 10 deg F tolerance, any zone.

1.9 TERMINAL HEATING AND COOLING EQUIPMENT

A. General. This section includes sequences of operation for the following equipment:

1. Variable Air Volume (VAV) Terminals with electric heat.
2. Rooftop unit static pressure control by-pass damper (BP)
3. Cabinet heaters (CH) and unit heaters (UH), hydronic heat.
4. Air Curtains with hydronic heat (ACH)
5. Radiant Ceiling Panel (RCP) with electric heat.
6. Ductless split-system heat pumps (HP)

B. VAV Terminals: The variable volume (VAV) terminal unit is controlled independent of system pressure fluctuations by an application specific DDC controller using electric actuation. Provide modulating 2-way valves for terminals equipped with hydronic heating coils. Provide a discharge air temperature sensor in the supply ductwork downstream of the VAV terminal. The space served by the VAV terminal unit is controlled in Occupied and Unoccupied modes as follows:

1. The VAV terminal unit is controlled within user defined maximum and minimum supply air volume settings. Minimum air settings shall be multiple range: for heating, for cooling, and for unoccupied cooling. The controller monitors the room temperature sensor and air velocity sensor and modulates the supply air and modulates the heating coil control valve to maintain the room temperature at set point.
2. Display:
 - a. Room/area served.
 - b. Room occupied/unoccupied.
 - c. Room temperature indication.
 - d. Room temperature set point, occupied.
 - e. Room temperature set point, unoccupied.
 - f. Air damper cooling and heating minimum and maximum settings.
 - g. Air-damper position as percent open.
 - h. Heating valve position as percent open or number of energized stages.
 - i. Discharge air temperature indication.
 - j. Space temperature warning if above or below setpoint by 10 deg F.

- C. Hydronic Unit Heaters (UH): For each unit, provide a 2-way, 2-position control valve, wall mounted temperature sensor, and pipe mounted aquastat. Open heating valve and cycle fan to maintain space setpoint temperature. Lockout fan operation when hot water is not available.

1.10 DUST/FUME COLLECTORS

- A. Dust Collection Unit DCU-1 and DCU-2: Install dust collection unit manufacturer's indoor remote control panel and provide the following additional controls:
 - 1. Provide remote start/stop switch and low voltage control wiring for each dust collector
 - 2. Provide control circuit relay and connect dust collector control panels to emergency stop switch provided by the electrical contractor.
 - 3. Provide an automatic winter-summer automatic changeover control including recirculation and exhaust damper assemblies. During winter mode, whenever outdoor air is below 65F, position dampers to enable dust collector discharge air to return to the welding shop. During summer mode, whenever outdoor air is above 65F, position dampers to discharge dust collector air to outdoors.
 - 4. Install a smoke detector (detector furnished by E.C.) in the supply air ductwork to the welding shop for each dust collector. De-energize the collector upon detector activation.

1.11 FANS, OUTSIDE AIR INTAKES, AND RELIEF VENTS

- A. Exhaust Fans: Refer to the Drawing for specific control requirements:
 - 1. For fans EF-101, EF-102, EF-103, EF-104 provide the following:
 - a. Install VFD remote keypad accessory where indicated on the plans; provide communication cabling to its respective VFD.
 - b. Provide a local manual start/stop switch mounted as indicated on the plans, wire to VFD start/stop contactor.
 - c. Wire manual start/stop switch to emergency stop switch provided by electrical contractor.
 - 2. For fans EF-105, EF-106 denoted "occ", energize the fan for continuous operation during occupied periods and de-energize fans during unoccupied periods.
 - 3. For fan EF-107 denoted "t-stat", provide a wall mounted thermostat and energize fan if space temperature rises above setpoint.
 - 4. For existing fans toilet room and storage room fans, energize fans for continuous operation during occupied periods and de-energize fans during unoccupied periods.
 - 5. Safeties: For each fan, provide a motor current sensor or monitor VFD status, indicate fan failure on the BMS.
- B. Relief Air Vents
 - 1. For relief air hoods and relief air louvers, provide two position dampers to open whenever outdoor air temperature rises above 55F.
- C. Outside Air Intake Hood (OAI-1)
 - 1. For outdoor intake hood OAI-1, provide a two position damper to open whenever DCU-1 and DCU-2 operate in the summer mode. For each damper, provide proof of open/closure.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
 - 1. Hot-water heating piping.
 - 2. Chilled water piping
 - 3. Makeup-water piping.
 - 4. Condensate-drain piping.
 - 5. Air-vent piping.
- B. Related Sections include the following:
 - 1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.3 DEFINITIONS

- A. PTFE: Polytetrafluoroethylene.

1.4 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
 - 1. Hot-Water Heating Piping: 100 psig at 200 deg F.
 - 2. Chilled Water Piping: 100 psig at 100 deg F.
 - 3. Makeup-Water Piping: 100 psig at 100 deg F.
 - 4. Condensate-Drain Piping: 100 deg F.
 - 5. Air-Vent Piping: 200 deg F.

1.5 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Plastic pipe and fittings with solvent cement.

2. Pressure-seal fittings.
3. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
4. Air control devices.
5. Hydronic specialties.

B. Welding certificates.

C. Qualification Data: For Installer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.7 EXTRA MATERIALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Fittings: ASME B16.22.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Company of America.
 - 2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
 - 3. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.
- E. Copper or Bronze Pressure-Seal Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Stadler-Viega.
 - 2. Housing: Copper.
 - 3. O-Rings and Pipe Stops: EPDM.
 - 4. Tools: Manufacturer's special tools.
 - 5. Minimum 200-psig working-pressure rating at 250 deg F.
- F. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.

- H. Grooved Mechanical-Joint Fittings and Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Company of America.
 - 2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - 3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

- I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 PLASTIC PIPE AND FITTINGS

- A. CPVC Plastic Pipe: ASTM F 441/F 441M, Schedules 40 and 80, plain ends as indicated in Part 3 "Piping Applications" Article.
- B. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.
- C. PVC Plastic Pipe: ASTM D 1785, Schedules 40 and 80, plain ends as indicated in Part 3 "Piping Applications" Article.
- D. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

2.4 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - a. Use CPVC solvent cement that has a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- H. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.5 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Charlotte Pipe and Foundry Company.
 - b. IPEX Inc.
 - c. KBi.
 - 3. CPVC and PVC one-piece fitting with one threaded brass or copper insert and one Schedule 80 solvent-cement-joint end.
- B. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Charlotte Pipe and Foundry Company.
 - b. IPEX Inc.
 - c. KBi.
 - d. NIBCO INC.
3. MSS SP-107, CPVC and PVC union. Include brass or copper end, Schedule 80 solvent-cement-joint end, rubber gasket, and threaded union.

2.6 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Flanges:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 2. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- D. Dielectric-Flange Kits:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- E. Dielectric Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. Calpico, Inc.
 - b. Lochinvar Corporation.
2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Perfection Corporation; a subsidiary of American Meter Company.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Victaulic Company of America.
 2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.7 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."
- C. Bronze, Calibrated-Orifice, Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - b. Flow Design Inc.
 - c. Griswold Controls.
 - d. Taco.
 2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 3. Ball: Brass or stainless steel.
 4. Plug: Resin.
 5. Seat: PTFE.
 6. End Connections: Threaded or socket.
 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 8. Handle Style: Lever, with memory stop to retain set position.
 9. CWP Rating: Minimum 125 psig.
 10. Maximum Operating Temperature: 250 deg F.
- D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - b. Flow Design Inc.
 - c. Griswold Controls.
 - d. Taco.
 - e. Tour & Andersson; available through Victaulic Company of America.
2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

2.8 AIR CONTROL DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Amtrol, Inc.
 2. Armstrong Pumps, Inc.
 3. Bell & Gossett Domestic Pump; a division of ITT Industries.
 4. Taco.
- B. Manual Air Vents:
 1. Body: Bronze.
 2. Internal Parts: Nonferrous.
 3. Operator: Screwdriver or thumbscrew.
 4. Inlet Connection: NPS 1/2.
 5. Discharge Connection: NPS 1/8.
 6. CWP Rating: 150 psig.
 7. Maximum Operating Temperature: 225 deg F.
- C. Automatic Air Vents:
 1. Body: Bronze or cast iron.
 2. Internal Parts: Nonferrous.
 3. Operator: Noncorrosive metal float.
 4. Inlet Connection: NPS 1/2.
 5. Discharge Connection: NPS 1/4.
 6. CWP Rating: 150 psig.
 7. Maximum Operating Temperature: 240 deg F.

2.9 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

C. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered, brazed, or pressure-seal joints.
2. Schedule 40 steel pipe; Class 125, cast-iron or Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Chilled Water piping, aboveground, NPS 2 and smaller, shall be any of the following:

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1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered, brazed, or pressure-seal joints.
 2. Schedule 40 steel pipe; Class 125, cast-iron or Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- D. Chilled Water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
 2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- E. Makeup-water piping installed aboveground shall be the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- F. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 CPVC plastic pipe and fittings and solvent-welded joints.
- G. Air-Vent Piping:
1. Inlet: Same as service where installed.
 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- C. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- D. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- E. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to

size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

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- T. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 4. Spring hangers to support vertical runs.
 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 4. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 5. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 6. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
 7. NPS 3: Maximum span, 12 feet; minimum rod size, 1/2 inch.
 8. NPS 3-1/2: Maximum span, 12 feet; minimum rod size, 1/2 inch.
 9. NPS 4: Maximum span, 12 feet; minimum rod size, 5/8 inch.
 10. NPS 5: Maximum span, 12 feet; minimum rod size, 5/8 inch.
 11. NPS 6: Maximum span, 12 feet; minimum rod size, 3/4 inch. (Addendum #3)
- E. Install hangers for drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 3/8 inch.
 2. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
 3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
- F. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

- G. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
 - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

- K. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.
- C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.
- D. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.
- E. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.
- F. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.

HYDRONIC PIPING

4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 3. Isolate expansion tanks and determine that hydronic system is full of water.
 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
 2. Inspect pumps for proper rotation.
 3. Set makeup pressure-reducing valves for required system pressure.
 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
 7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232923 – VARIABLE FREQUENCY DRIVES

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 separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

1.3 DEFINITIONS

- A. BAS: Building automation system (aka BMS)
- B. CPT: Control power transformer.
- C. EMI: Electromagnetic interference.
- D. IGBT: Insulated-gate bipolar transistor.
- E. LED: Light-emitting diode.
- F. MCP: Motor-circuit protector.
- G. NC: Normally closed.
- H. NO: Normally open.
- I. OCPD: Overcurrent protective device.
- J. PID: Control action, proportional plus integral plus derivative.
- K. PWM: Pulse-width modulated.
- L. RFI: Radio-frequency interference.
- M. TDD: Total demand (harmonic current) distortion.
- N. THD(V): Total harmonic voltage demand.
- O. VFD: Variable frequency drive.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and rating of VFD indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.
- B. Shop Drawings: For each VFD indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
 - 1. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Each installed unit's type and details.
 - b. Factory-installed devices.
 - c. Enclosure types and details.
 - d. Nameplate legends.
 - e. Short-circuit current (withstand) rating of enclosed unit.
 - f. Features, characteristics, ratings, and factory settings of each VFC and installed devices.
 - g. Specified modifications.
 - 2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Certificates: For each VFD, from manufacturer.
- C. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.
- G. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For VFDs to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and MCP trip settings.
2. Manufacturer's written instructions for setting field-adjustable overload relays.
3. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
4. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Power Fuses: Three for each size and type.
 2. Control Power Fuses: Three for each size and type.
 3. Indicating Lights: Two of each type and color installed.
 4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
 5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. IEEE Compliance: Fabricate and test VFC according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than 14 deg F and not exceeding 104 deg F.
2. Humidity: Less than 95 percent (noncondensing).
3. Altitude: Not exceeding 3300 feet.

1.11 COORDINATION

- A. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:
 1. Torque, speed, and horsepower requirements of the load.
 2. Ratings and characteristics of supply circuit and required control sequence.
 3. Ambient and environmental conditions of installation location.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ABB.
 2. Danfoss Inc.; Danfoss Drives Div.
 3. Square D; a brand of Schneider Electric.
 4. Johnson Controls Inc.
- B. General Requirements for VFDs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.
- C. Application: variable torque.
- D. VFD Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and
VARIABLE-FREQUENCY MOTOR CONTROLLERS **232923 - 4**

- General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
 3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
- E. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- F. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
- G. Unit Operating Requirements:
1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFD input voltage rating.
 2. Input AC Voltage Unbalance: Not exceeding 3 percent.
 3. Input Frequency Tolerance: Plus or minus 3 percent of VFD frequency rating.
 4. Minimum Efficiency: 96 percent at 60 Hz, full load.
 5. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
 6. Ambient Temperature Rating: Not less than 14 deg F and not exceeding 104 deg F.
 7. Ambient Storage Temperature Rating: Not less than minus 4 deg F and not exceeding 140 deg F
 8. Humidity Rating: Less than 95 percent (noncondensing).
 9. Altitude Rating: Not exceeding 3300 feet.
 10. Overload Capability: 1.5 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 11. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
 12. Speed Regulation: Plus or minus 5 percent.
 13. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
 14. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
- H. Inverter Logic: Microprocessor based, 32 bit, isolated from all power circuits.
- I. Isolated Control Interface: Allows VFds to follow remote-control signal over a minimum 40:1 speed range.
1. Signal: Electrical.
- J. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 3. Acceleration: 0.1 to 999.9 seconds.
 4. Deceleration: 0.1 to 999.9 seconds.
 5. Current Limit: 30 to minimum of 150 percent of maximum rating.
- K. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
 3. Under- and overvoltage trips.
 4. Inverter overcurrent trips.
 5. VFD and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFDs and motor thermal characteristics, and for providing VFD overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
 6. Critical frequency rejection, with three selectable, adjustable deadbands.
 7. Instantaneous line-to-line and line-to-ground overcurrent trips.
 8. Loss-of-phase protection.
 9. Reverse-phase protection.
 10. Short-circuit protection.
 11. Motor overtemperature fault.
- L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.
- M. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
- N. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- O. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- P. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- Q. Integral Input Disconnecting Means and OCPD: NEMA AB 1, instantaneous-trip circuit breaker with pad-lockable, door-mounted handle mechanism.
1. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFD input current rating, whichever is larger.
 2. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.
 3. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
 4. NO alarm contact that operates only when circuit breaker has tripped.

2.2 CONTROLS AND INDICATION

- A. Status Lights: Door-mounted LED indicators displaying the following conditions:
1. Power on.

2. Run.
 3. Overvoltage.
 4. Line fault.
 5. Overcurrent.
 6. External fault.
- B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
 2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
 - a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.
- C. Historical Logging Information and Displays:
1. Real-time clock with current time and date.
 2. Running log of total power versus time.
 3. Total run time.
 4. Fault log, maintaining last four faults with time and date stamp for each.
- D. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFC parameters including, but not limited to:
1. Output frequency (Hz).
 2. Motor speed (rpm).
 3. Motor status (running, stop, fault).
 4. Motor current (amperes).
 5. Motor torque (percent).
 6. Fault or alarming status (code).
 7. PID feedback signal (percent).
 8. DC-link voltage (V dc).
 9. Set point frequency (Hz).
 10. Motor output voltage (V ac).
- E. Control Signal Interfaces:
1. Electric Input Signal Interface:
 - a. A minimum of two programmable analog inputs.
 - b. A minimum of six multifunction programmable digital inputs.
 - c. Coordinate control characteristics with ATC Contractor.
 2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:
 - a. 0- to 10-V dc.
 - b. 4- to 20-mA dc.

- c. Potentiometer using up/down digital inputs.
 - d. Fixed frequencies using digital inputs.
3. Output Signal Interface: A minimum of two programmable analog output signal(s) (0- to 10-V dc, 4- to 20-mA dc, operator-selectable "x"- to "y"-mA dc), which can be configured for any of the following:
- a. Output frequency (Hz).
 - b. Output current (load).
 - c. DC-link voltage (V dc).
 - d. Motor torque (percent).
 - e. Motor speed (rpm).
 - f. Set point frequency (Hz).
4. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
- a. Motor running.
 - b. Set point speed reached.
 - c. Fault and warning indication (overtemperature or overcurrent).
 - d. PID high- or low-speed limits reached.
- F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.
- 1. Number of Loops: Two.
- G. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms and energy usage. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.
- 1. Embedded BAS Protocols for Network Communications: Johnson Metasys; protocols accessible via the communications ports.

2.3 ACCESSORIES

- A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.
 - 1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, type.
- B. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
 - 1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

2.4 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect VFDs according to requirements in NEMA ICS 61800-2.
 - 1. Test each VFD while connected to a motor that is comparable to that for which the VFD is rated.
 - 2. Verification of Performance: Rate VFDs according to operation of functions and features specified.
- B. VFDs will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive VFDs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance.
- B. Examine VFD before installation. Reject VFDs that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFD installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate layout and installation of VFDs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Wall-Mounting Controllers: Install VFD on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall.
- C. Install fuses in each fusible-switch VFD.
- D. Install fuses in control circuits if not factory installed.
- E. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

- G. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify VFDs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each VFD with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.
- B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between VFDs and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic control devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.
 - 2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. VFCs will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports, including a certified report that identifies the VFD and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.
- D. Set the taps on reduced-voltage autotransformer controllers.
- E. Set field-adjustable circuit-breaker trip ranges
- F. Set field-adjustable pressure switches.

3.8 PROTECTION

- A. Replace VFds whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 232923

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

- B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 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 performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

- A. Product Data: For each type of the following products:
1. Liners and adhesives.

2. Sealants and gaskets.
- 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 of ducts.
 5. Dimensions of main duct runs from building grid lines.
 6. Fittings.
 7. Reinforcement and spacing.
 8. Seam and joint construction.
 9. Penetrations through fire-rated and other partitions.
 10. Equipment installation based on equipment being used on Project.
 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 12. Hangers and supports, including methods for duct and building attachment 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.
- D. Coordination Drawings: 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. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 2. Suspended ceiling components.
 3. Structural members to which duct will be attached.
 4. Size and location of initial access modules for acoustical tile.
 5. Penetrations of smoke barriers and fire-rated construction.
 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Smoke detectors
 - e. Access panels.
 - f. Perimeter moldings.
 - g. Movable partition tracks and curtain tracks.
- E. Welding certificates.
- F. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.

- c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," 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 according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "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."

2.3 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 A 653/A 653M.
- 1. Galvanized Coating Designation: G90.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B 209 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 A 36/A 36M, 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.

2.4 DUCT LINER

- A. Application: Duct liner shall be strictly limited to the following applications:
 - 1. Transfer air ducts.
 - 2. Ducts specifically noted on the drawings.
- B. Natural-Fiber Duct Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor and complying with NFPA 90A or NFPA 90B.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonded Logic, Inc.
 - b. Reflectix Inc.
 - 2. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested according to ASTM C 518.
 - 3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to ASTM E 84; certified by an NRTL.
 - 4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. 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 galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "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.
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. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. 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.

2.5 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 according to 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.
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.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated 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 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated 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 according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.

- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. 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.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

- A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
- B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as

indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

- C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Exhaust Ducts: Seal Class B.
 - 3. Outdoor, Return-Air Ducts: Seal Class B.
 - 4. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 6. Unconditioned Space, Exhaust Ducts: Seal Class B.
 - 7. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 8. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 10. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 11. Conditioned Space, Return-Air Ducts: Seal Class B.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, mechanical fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.
- B. Supply Ducts:
 - 1. Ducts Connected downstream of Terminal Units:
 - a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 - 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 - 3. Ducts Connected to Variable-Air-Volume Air-Handling Units and Rooftop Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- C. Return Ducts:
- D. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 1-inch wg.

METAL DUCTS

- b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
2. Ducts Connected to Dust Collection Equipment:
- a. Pressure Class: Negative 12-inch wg. Postive 2-inch.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and B if positive pressure.
 - c. SMACNA Leakage Class for Round and Flat Oval: 3.
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
1. Ducts Connected to Louvers and Outside Air Intake Hoods
- a. Pressure Class: Negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- F. 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.
- G. Liner:
1. Transfer Air Ducts, Return Air Ducts: Natural fiber, 1 inch thick.
- H. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "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 2-3,

"Vaness and Vane Runners," and Figure 2-4, "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 2-3, "Vaness and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "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 2-3, "Vaness and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "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, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Welded.
- I. Branch Configuration:
 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

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- 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. Barometric relief dampers.
 3. Manual volume dampers.
 4. Fire dampers.
 5. Flange connectors.
 6. Duct silencers.
 7. Turning vanes.
 8. Duct-mounted access doors.
 9. Flexible connectors.
 10. Flexible ducts.
 11. Duct accessory hardware.
- B. Related Sections:
1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
 2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
1. For duct silencers, include pressure drop and dynamic insertion loss 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. Control damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Wiring Diagrams: For power, signal, and control wiring.
- C. Source quality-control reports.

- D. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

- 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 AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

- 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 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- 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.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Duro Dyne Inc.
 - 5. Greenheck Fan Corporation.
 - 6. Lloyd Industries, Inc.

7. Nailor Industries Inc.
 8. NCA Manufacturing, Inc.
 9. Ruskin Company.
 10. SEMCO Incorporated.
 11. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 1-inch wg.
- E. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners and mounting flange.
- F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch width, 0.050-inch- thick aluminum sheet with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Neoprene, mechanically locked.
- I. Blade Axles:
 1. Material: Galvanized steel.
- J. Tie Bars and Brackets: Aluminum.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball or synthetic pivot bushings.
- M. Accessories:
 1. Adjustment device to permit setting for varying differential static pressure.
 2. Counterweights and spring-assist kits for vertical airflow installations.
 3. Electric actuators.
 4. Chain pulls.
 5. Front of rear screens.
 6. 90-degree stops.
- N. Sleeve: Minimum 20-gage thickness.

2.3 BAROMETRIC RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Air Balance Inc.; a division of Mestek, Inc.
 2. American Warming and Ventilating; a division of Mestek, Inc.
 3. Cesco Products; a division of Mestek, Inc.
 4. Duro Dyne Inc.
 5. Greenheck Fan Corporation.
 6. Lloyd Industries, Inc.
 7. Nailor Industries Inc.
 8. NCA Manufacturing, Inc.
 9. Ruskin Company.

AIR DUCT ACCESSORIES

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10. SEMCO Incorporated.
11. Vent Products Company, Inc.

- B. Suitable for horizontal or vertical mounting.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: 0.064-inch- thick, galvanized sheet steel, with welded corners and mounting flange.
- F. Blades:
 1. Multiple, 0.050-inch- thick aluminum sheet.
 2. Maximum Width: 6 inches.
 3. Action: Parallel.
 4. Balance: Gravity.
 5. Eccentrically pivoted.
- G. Blade Seals: Neoprene.
- H. Blade Axles: Galvanized steel.
- I. Tie Bars and Brackets:
 1. Material: Aluminum.
 2. Rattle free with 90-degree stop.
- J. Return Spring: Adjustable tension.
- K. Bearings: Synthetic.
- L. Accessories:
 1. Flange on intake.
 2. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS

- A. Low-Leakage, Steel, Manual Volume Dampers:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Ruskin Company.
 - h. Trox USA Inc.
 - i. Vent Products Company, Inc.
 2. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 3. Suitable for horizontal or vertical applications.
 4. Frames:
 - a. Hat shaped.

- b. Galvanized-steel channels, 0.064 inch thick.
- c. Mitered and welded corners.
- d. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized, roll-formed steel, 0.064 inch thick.
- 6. Blade Axles: Galvanized steel.
- 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Blade Seals: Neoprene.
- 9. Jamb Seals: Cambered aluminum.
- 10. Tie Bars and Brackets: Aluminum.
- 11. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

2.5 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Arrow United Industries; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Greenheck Fan Corporation.
 - 5. McGill AirFlow LLC.
 - 6. METALAIRE, Inc.
 - 7. Nailor Industries Inc.
 - 8. NCA Manufacturing, Inc.
 - 9. Prefco; Perfect Air Control, Inc.
 - 10. Ruskin Company.
 - 11. Vent Products Company, Inc.
 - 12. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Type: Static; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

AIR DUCT ACCESSORIES

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- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.6 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.7 DUCT SILENCERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Industrial Noise Control, Inc.
 - 2. McGill AirFlow LLC.
 - 3. Ruskin Company.
 - 4. Vibro-Acoustics.
- B. General Requirements:
 - 1. Factory fabricated.
 - 2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
- C. Shape:
 - 1. Rectangular straight with splitters or baffles.
 - 2. Round straight with center bodies or pods.
 - 3. Rectangular elbow with splitters or baffles.
 - 4. Round elbow with center bodies or pods.
 - 5. Rectangular transitional with splitters or baffles.
- D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90, galvanized sheet steel, 0.040 inch thick.
- E. Round Silencer Outer Casing: ASTM A 653/A 653M, G60, galvanized sheet steel.
 - 1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
 - 2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.

3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.052 inch thick.
 4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.
- F. Inner Casing and Baffles: ASTM A 653/A 653M, G90 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch- diameter perforations.
- G. Special Construction:
1. Suitable for outdoor use.
 2. High transmission loss to achieve STC 45.
- H. Connection Sizes: Match connecting ductwork unless otherwise indicated.
- I. Principal Sound-Absorbing Mechanism:
1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
 2. Dissipative type with fill material.
 - a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 15 percent compression.
 - b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.
- J. Accessories:
1. Factory-installed end caps to prevent contamination during shipping.
 2. Removable splitters.
- K. Source Quality Control: Test according to ASTM E 477.
1. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
 2. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

2.8 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. METALAIRE, Inc.
 4. SEMCO Incorporated.
 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. 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.

- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vaness and Vane Runners," and 2-4, "Vane Support in Elbows."
- E. Vane Construction: Single wall.
- F. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.9 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Warming and Ventilating; a division of Mestek, Inc.
 - 2. Cesco Products; a division of Mestek, Inc.
 - 3. Ductmate Industries, Inc.
 - 4. Flexmaster U.S.A., Inc.
 - 5. Greenheck Fan Corporation.
 - 6. McGill AirFlow LLC.
 - 7. Nailor Industries Inc.
 - 8. Ventfabrics, Inc.
 - 9. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 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.

2.10 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 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.

E. 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.

F. 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.

2.12 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. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.

D. Flexible Duct Connectors:

1. 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.

2.13 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. 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. Coordinate subparagraphs below with Division 23 Section "Metal Ducts." Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire dampers according to UL listing.
- H. Connect ducts to duct silencers rigidly.
- 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. Adjacent to and close enough to fire 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.
 - 3. At each change in direction and at maximum 50-foot spacing.
 - 4. Upstream of turning vanes.
 - 5. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.

- K. Access Door Sizes:
 - 1. Head and Hand Access: 18 by 10 inches.
- L. Label access doors according to Division 23 Section "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-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Connect terminal units to supply ducts directly. Do not use flexible ducts.
- P. Connect diffusers with maximum 60-inch lengths of flexible duct clamped in place.
- Q. Connect flexible ducts to metal ducts with draw bands.
- R. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Inspect turning vanes for proper and secure installation.
 - 4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

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. Centrifugal roof ventilators.
 - 2. Centrifugal utility exhaust fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Field quality-control reports.
- D. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.6 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 EXTRA MATERIALS

- 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 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. PennBarry.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
 - 1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.
 - 2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Belt Drives:
 - 1. Resiliently mounted to housing.
 - 2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 18 inches].
3. Sound Curb: Curb with sound-absorbing insulation.
4. Vented Curb: Unlined with louvered vents in vertical sides.

2.2 CENTRIFUGAL UTILITY EXHAUST FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt or direct-driven centrifugal fan utility vent sets, consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.

C. Housings:

1. Housing Material: Reinforced steel.
2. Housing Coating: Epoxy.
3. Formed panels to make curved-scroll housings with shaped cutoff.
4. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
5. Discharge Arrangement: Fan scroll housing field rotatable discharge positions. Provide fan with discharge positioned in proper direction to minimize connected duct turns.

D. Wheels:

1. Wheel Configuration: SWSI, with hub keyed to shaft.

2. Wheel and Blade Materials: Steel.
 3. Wheel and Blade Coating: None.
 4. Backward-Inclined Airfoil Blades:
 - a. Aerodynamic design.
 - b. Heavy backplate.
 - c. Hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate.
 5. Backward-Inclined Curved Blades:
 - a. Curved design.
 - b. Heavy backplate.
 - c. Single-thickness blades continuously welded at tip flange and backplate.
 6. Backward-Inclined Flat Blades:
 - a. Flat design.
 - b. Heavy backplate.
 - c. Single-thickness blades continuously welded at tip flange and backplate.
- E. Shafts:
1. Turned, ground, and polished steel; keyed to wheel hub. First critical speed at least 1.4 times maximum class speed.
- F. Bearings:
1. Heavy-duty regreasable ball or roller type in a cast iron pillowblock housing.
 2. Ball-Bearing Rating Life: ABMA 9, L(50) of 200,000 hours.
 3. Roller-Bearing Rating Life: ABMA 11, L(50) of 200,000 hours.
 4. Extend grease fitting to accessible location outside of unit.
- G. Belt Drive:
1. Factory mounted, with final alignment and belt adjustment made after installation.
 2. Service Factor Based on Fan Motor Size: 1.2.
 3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 4. Motor Pulleys: Adjustable pitch.
 5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 6. Belt Guards: Comply with OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards," diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short-circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
- H. Accessories:
1. Inlet and Outlet: Flanged.

2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
3. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades, with felt edges in steel frame installed on fan discharge.
4. Access Door: Gasketed door in scroll with latch-type handles.
5. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.
6. Inlet Screens: Removable wire mesh.
7. Outlet Screens: Removable wire mesh.
8. Belt Guard: OSHA-compliant, completely enclosed shaft and drive components.
9. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
10. Drain Connections: NPS 3/4 threaded coupling drain connection installed at lowest point of housing.
11. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
12. Discharge Dampers: Assembly with parallel blades constructed of two plates formed around, and to, shaft, channel frame, and sealed ball bearings, with blades linked outside of airstream to single control lever of same material as housing.
13. Grease Collection Trough and Receiver: For restaurant exhaust application.
14. Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "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. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

2.4 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.

- B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Division 07 Section "Roof Accessories" for installation of roof curbs.
- C. Support suspended units from structure using threaded steel rods and elastomeric hangers. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- 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. 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.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. 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.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. 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.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 10. Shut unit down and reconnect automatic temperature-control operators.
 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Shutoff, single-duct air terminal units with hydronic heating coils.

1.3 SUBMITTALS

- A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.
 - 1. Air terminal units.
- B. Field quality-control reports.
- C. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Instructions for resetting minimum and maximum air volumes.
 - 2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 - PRODUCTS

2.1 AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier
 2. Titus.
 3. Trane.
 4. Daikin
 5. Price
- B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud for installation above a ceiling. For fan powered terminals, fan arrangement shall be as indicated on the drawings.
- C. Casing: 0.034-inch steel, double wall.
1. Casing Lining: Adhesive attached, foil-faced 1/2-inch- thick fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - a. Cover liner with nonporous foil.
 2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
 3. Air Outlet: S-slip and drive connections.
 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- D. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg inlet static pressure.
 2. Damper Position: Normally open.
- E. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.
- F. Attenuator Section: 0.034-inch steel sheet.
1. Lining: Adhesive attached, 1/2-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
 - a. Cover liner with nonporous foil.

2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.
- H. Direct Digital Controls: Single-package unitary controller and actuator specified in Division 23 Section "Instrumentation and Control for HVAC."
- I. Accessories: Provide control circuit disconnect switch and 24V/120V control circuit transformer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- C. Install wall-mounted thermostats.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Mechanical fasteners or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Install mechanical fasteners after concrete is placed and completely cured.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

- A. Install piping adjacent to air terminal unit to allow service and maintenance.
- B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

- C. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."
- D. Make connections to fan powered air terminal units with flexible connectors complying with requirements in Division 23 Section "Air Duct Accessories."

3.4 IDENTIFICATION

- A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Air terminal unit will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - 3. Verify that controls and control enclosure are accessible.
 - 4. Verify that control connections are complete.
 - 5. Verify that nameplate and identification tag are visible.
 - 6. Verify that controls respond to inputs as specified.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

SECTION 233713 - DIFFUSERS, 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. Rectangular and square ceiling diffusers.
2. Louver face diffusers.
3. Fixed face registers and grilles.
4. Louvers

- B. Related Sections:

1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:

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, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

PART 2 - PRODUCTS

2.1 DIFFUSERS, REGISTERS, AND GRILLES

- A. Manufacturers

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nailor Industries Inc.

- b. Price Industries.
- c. Titus.
- d. Tuttle & Bailey.

B. Rectangular and Square Ceiling Diffusers and Louver Face Diffusers:

- 1. Devices shall be specifically designed for variable-air-volume flows.
- 2. Material: Aluminum, insulated.
- 3. Finish: Baked enamel, white.
- 4. Mounting: T-bar mounting panel, nominal 24 x 24, except where mounted in plaster ceilings..
- 5. Dampers: opposed blade.
- 6. Accessories:
 - a. Plaster ring for plaster ceilings.
 - b. Safety chain.
 - c. Square to round neck adapter.

2.2 REGISTERS AND GRILLES

A. Manufacturers

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Nailor Industries Inc.
 - b. Price Industries.
 - c. Titus.
 - d. Tuttle & Bailey.

B. Double Deflection Registers:

- 1. Material: Aluminum.
- 2. Finish: Baked enamel, white; mill finish where specifically noted.
- 3. Face Blade Arrangement: Horizontal.
- 4. Core Construction: Integral.
- 5. Rear-Blade Arrangement: Vertical.
- 6. Frame: 1-1/4 inches wide.
- 7. Mounting: Countersunk screw.
- 8. Damper Type: Adjustable opposed blade.

C. Fixed Face Grille:

- 1. Material: Aluminum.
- 2. Finish: Baked enamel, white.
- 3. Frame: 1-1/4 inches wide.
- 4. Mounting: Countersunk screw.

D. Heavy Duty Fixed Face Grille:

- 1. Material: Steel
- 2. Finish: Baked enamel, white.
- 3. Frame: 1-1/4 inches wide.
- 4. Mounting: Countersunk screw.

DIFFUSERS, REGISTERS, AND GRILLES

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2.3 LOUVERS

A. Horizontal, Drainable-Blade Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a Mestek company.
 - b. Air Flow Company, Inc.
 - c. American Warming and Ventilating, Inc.; a Mestek company.
 - d. Arrow United Industries; a division of Mestek, Inc.
 - e. Greenheck Fan Corporation.
 - f. Louvers & Dampers, Inc.; a division of Mestek, Inc.
 - g. NCA Manufacturing, Inc.
 - h. Ruskin Company; Tomkins PLC.
2. Louver Depth: 6 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.

B. Mullion Type: Exposed.

C. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: As selected by Architect from full range of industry colors and color densities.

2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, 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 diffusers, registers, and grilles are to be 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, registers, and grilles 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

DIFFUSERS, REGISTERS, AND GRILLES

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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, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
 - 1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
 - 2. Form closely fitted joints with exposed connections accurately located and secured.
 - 3. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
 - 4. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
 - 5. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
 - 6. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 233723 - HVAC GRAVITY VENTILATORS

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. Roof hoods.
 - 2. Goosenecks.

1.3 PERFORMANCE REQUIREMENTS

- A. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1-2004.

1.4 SUBMITTALS

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

1.5 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

- D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

2.2 FABRICATION, GENERAL

- A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
- D. Fabricate supports, anchorages, and accessories required for complete assembly.
- E. Perform shop welding by AWS-certified procedures and personnel.

2.3 ROOF HOODS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. PennBarry.
- B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.
- C. Materials: Aluminum sheet, minimum 0.063-inch- thick base and 0.050-inch- thick hood; suitably reinforced.
- D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Self-flashing without a cant strip, with mounting flange.
 - 2. Overall Height: 18 inches.
- E. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.

2.4 GOOSENECKS

- A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 5-5; with a minimum of 0.052-inch- thick, galvanized-steel sheet.

- B. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Self-flashing without a cant strip, with mounting flange.
 - 2. Overall Height: 18 inches.
- C. Bird Screening: Galvanized-steel, 1/2-inch- square mesh, 0.041-inch wire.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Install goosenecks on curb base where throat size exceeds 12 by 12 inches.
- C. Install gravity ventilators with clearances for service and maintenance.
- D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 Section "Joint Sealants" for sealants applied during installation.
- F. Label gravity ventilators according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."
- G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.

END OF SECTION 233723

SECTION 234100 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications:
 - 1. Pleated panel filters.
 - 2. Bag filters.
 - 3. Side-access filter housings.
 - 4. Filter gauges.
- B.

1.3 DEFINITIONS

- A. DOP: Dioctyl phthalate or bis-(2-ethylhexyl) phthalate.

1.4 SUBMITTALS

- A. Product Data: Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

1.5 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air filters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Comply with ARI 850.
- C. Comply with ASHRAE 52.1 and ASHRAE 52.2 for method of testing and rating air-filter units.
- D. Comply with NFPA 70 for installing electrical components.
- E. Comply with NFPA 90A and NFPA 90B.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Provide one complete set of filters for each filter bank. If system includes prefilters, provide only prefilters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Filtration Group.
 - c. Farr Co.
 - d. Flanders/CSC Corp.
 - e. Flanders Filters, Inc.
 - f. General Filters Inc.

2.2 PLEATED PANEL FILTERS

- A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
- B. Source Limitations: Obtain from single source from single manufacturer.
- C. Capacities and Characteristics:
 - 1. Minimum Efficiency Reporting Value: MERV 8, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.
- D. Media: Interlaced glass or Cotton and synthetic fibers coated with nonflammable adhesive. Coat media with an antimicrobial agent.
 - 1. Separators shall be bonded to the media to maintain pleat configuration.
 - 2. Welded-wire grid shall be on downstream side to maintain pleat.
 - 3. Media shall be bonded to frame to prevent air bypass.
 - 4. Support members on upstream and downstream sides to maintain pleat spacing.
- E. Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.

2.3 BAG FILTERS

- A. Description: Factory-fabricated, dry, extended-surface, filters with header frames.
- B. Source Limitations: Obtain from single source from single manufacturer.
- C. Capacities and Characteristics:

1. Minimum Efficiency Reporting Value: MERV 13, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.

D. Media: Synthetic material constructed so individual pockets are maintained in tapered form under rated-airflow conditions by flexible internal supports. Coat media with an antimicrobial agent.

E. Filter-Media Frame: Galvanized steel.

2.4 SIDE-ACCESS FILTER HOUSINGS

A. Description: Factory-assembled, weather-resistant, side-service housings, constructed of galvanized steel or aluminum, with flanges to connect to duct or casing system.

B. Source Limitations: Obtain from single source from single manufacturer.

C. Prefilters: Integral tracks to accommodate 2-inch-thick, disposable filters.

D. Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking devices, and arranged so filter cartridges can be loaded from either access door.

E. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.

2.5 FILTER GAUGES

A. Diaphragm-type gauge with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.

B. Source Limitations: Obtain from single source from single manufacturer.

1. Diameter: 4-1/2 inches (115 mm).

2. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg or Less: 0- to 2.0-inch wg.

C. Manometer-Type Filter Gauge: Molded plastic, with epoxy-coated aluminum scale and logarithmic-curve tube gage with integral leveling gage, graduated to read from 0- to 3.0-inch wg (0 to 750 Pa), and accurate within 3 percent of the full-scale range.

D. Accessories: Static-pressure tips, tubing, gauge connections, and mounting bracket.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install filter frames according to manufacturer's written instructions.

- B. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- C. Install filters in position to prevent passage of unfiltered air.
- D. Install filter gage for each filter bank.
- E. Install filter gage static-pressure taps upstream and downstream from filters to measure pressure drop through filter. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
- F. Coordinate filter installations with duct and air-handling unit installations.
- G. Electrical wiring and connections are specified in Division 26 Sections.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.2 CLEANING

- A. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 234100

SECTION 237313 - MODULAR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Modular air-handling units, indoor and outdoor.

1.3 SUBMITTALS

- A. Product Data: For each air-handling unit indicated.
1. Unit dimensions and weight.
 2. Cabinet material, metal thickness, finishes, insulation, and accessories.
 3. Fans:
 - a. Certified fan-performance curves with system operating conditions indicated.
 - b. Certified fan-sound power ratings.
 - c. Fan construction and accessories.
 - d. Motor ratings, electrical characteristics, and motor accessories.
 4. Certified coil-performance ratings with system operating conditions indicated.
 5. Dampers, including housings, linkages, and operators.
 6. Filters with performance characteristics.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Wiring Diagrams: Power, signal, and control wiring.
 2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
- C. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Structural members to which RTUs will be attached.
 2. Roof openings

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- 3. Roof curbs and flashing.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- E. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- F. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

1.6 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set(s) for each air-handling unit.
 - 2. Fan Belts: One set(s) for each air-handling unit fan.
 - 3. Fan and motor pulleys, to provide one complete change after preliminary air balancing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain one of two paragraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

- A. Manufacturers:
 - 1. Carrier
 - 2. Trane
 - 3. York (JCI)

2.2 GENERAL

- A. Manufacturer must clearly define any exceptions made to Plans and Specifications. Mechanical Contractor is responsible for expenses that occur due to exceptions made.
- B. Unit must be specifically designed for outdoor installation.
- C. Factory fabricate air handling units of sizes, capacities, and configurations as scheduled on drawings.
- D. The unit shall be able to withstand up to 1.5 times design static pressure, or 8-inch wc whichever is less, with no more than 0.005 inch deflection per inch of panel span.

2.3 UNIT BASE

- A. Base shall be welded supporting the entire length and width of the unit. Units shipped in one piece shall have at a minimum six points of lift. These lift points shall be designed to accept standard rigging devices.
- B. The unit base design shall allow unit to rest on top of roofcurb when field installed. Entire length and width under base shall be sealed in the field with curb gasketing for weather tight seal.

2.4 CASING

- A. All panels shall be double wall construction. Interior and exterior panels shall be constructed of galvanized steel. Panel insulation system shall provide a minimum R value of 12. Insulation shall conform to NFPA 90 requirements.
- B. Panels shall be fully removable to allow for a proper way to thoroughly clean panels and to access internal parts. If panels are not removable, then manufacturer shall provide access sections with doors between all internal components to ensure access and cleanability of the air handler.
- C. Access doors shall be constructed with a double-wall of solid G90 galvanized steel interior panel. Gasketing around the full perimeter of the access door shall be used to

prevent air and water leakage. Preferred door handle shall not penetrate door casing with single-handle latch.

- D. External surface of unit casing shall be prepared and factory coated with a minimum 1.5 mil enamel finish or equal. Unit casing exterior with factory coating shall be able to withstand a salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours.
- E. Unit roof shall be sloped a minimum .25 inch per foot either from one side of unit to other or from center to sides of the unit. Roof assembly shall overhang all walls of units by 2 inch minimum.
- F. For units with outside air requirements, manufacturer shall provide inlet hood with high performance sine wave moisture eliminator to prevent water carryover into unit casing from outside air. Hoods shall be sized for 100% economizer cycle. If eliminator is not factory provided, contractor shall be responsible for field supplying and installing in manufacturers standard outside air inlet hood (s). If louvers are provided, then louvers shall be tested by an Independent AMCA approved laboratory for water carryover and air pressure drop in accordance with AMCA Standard 500, and testing reports shall be supplied with the submittal data.

2.5 FANS SECTIONS

- A. Provide fan section(s) with double width, double inlet centrifugal fan designed and suitable for class of service indicated in the unit schedule. Fan shaft to be properly sized and protectively coated with lubricating oil. Fan shafts shall be solid and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. Fans shall be statically and dynamically tested as an assembly at the required RPM to meet design specifications. Key fan wheels to fan shaft to prevent slipping.
 - 1. Provide self-aligning, grease lubricated pillow-block ball bearings selected for L-50 200,000 hour average life per ANSI/AFBMA 9. Extend both grease lubrication fittings to drive side of unit with plastic tubes and zerk fittings rigidly attached to drive side bearing support.
- B. Mount fans on isolation bases. Internally mount motors on same isolation bases and internally isolate fans and motors with spring isolators. Install flexible canvas ducts between fan and casings to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A. If no isolators or flexible canvas duct is provided, then the entire unit shall be externally isolated from the supply duct work and piping by contractor in order to avoid transmission of noise and vibration through the ductwork.
- C. Fan sections shall have full height, double wall, hinged doors for inspection and maintenance of internal components. Construct doors in accordance with Article 2.03 Paragraph E.
- D. Weigh fan and motor assembly at AHU manufacturer's factory for isolator selection. Statically and dynamically balance fan section assemblies. Fan section assemblies include fan wheels, shafts, bearings, drives, belts, isolation bases and isolators. Allow isolators to free float when performing fan balance. Measure vibration at each fan shaft bearing in horizontal, vertical and axial directions. Balance at design RPM as scheduled on drawings.

2.6 MOTORS AND DRIVES

- A. Factory install all motors on slide base to permit adjustment of belt tension.
- B. Fan Motors shall be heavy duty, premium efficiency suitable for use with variable frequency drive.
- C. V-Belt Drive shall be variable pitch rated at 1.5 times the motor nameplate.
- D. Refer to Section 230513 for additional requirements.

2.7 COILS SECTION

- A. Coils shall be manufactured by the same company as the supplier of the air handling unit. Install coils such that headers and return bends are enclosed by unit casings.
- B. The wet section of the unit, defined as the entering air side of the dehumidification coil to the leaving edge of the drain pan, shall be insulated. The insulation shall meet UL 181 requirements. The air stream surface of the insulation shall be constructed or coated such that it is not biodegradable, repels water and it can be cleaned to prevent microbial growth. The manufacturer's maintenance instructions shall describe the proper cleaning procedure for the unit.
- C. Construct coils of plate fins and seamless tubes. Fins shall have collars drawn, belled and firmly bonded to tubes by means of mechanical expansion of tubes. Do not use soldering or tinning in bonding process.
- D. Construct cooling coil casings of stainless steel and heating coil casings of galvanized steel with formed end supports and top and bottom channels. If two or more coils are stacked in unit, install intermediate drain channels between coils to drain condensate to main drain pans without flooding lower coils or passing condensate through airstream.
- E. Water Cooling Coils
 - 1. Clearly label supply and return headers on outside of units such that direction of coil water flow is counter to direction of unit airflow.
 - 2. Coils shall be proof tested to 300 psig and leak tested to 200 psig air pressure under water.
 - 3. Construct headers of round copper pipe or cast iron.
 - 4. Construct tubes of 1/2 inch O.D. minimum <<COPPER_THICKNESS3>> inch thick copper and construct fins of aluminum.

2.8 DRAIN PAN CONSTRUCTION

- A. The sealed double wall drain pan shall be constructed of stainless steel and insulated to prevent sweating. The bottom of the drain pan shall be sloped in two planes which pitch the condensate to the drain connection. The drain pan, when the unit is installed and trapped per the manufacturer's installation manual, shall be designed to leave puddles no more than 2-inches in diameter and no more than 1/8-inch deep.

2.9 EXTERNAL PIPING ENCLOSURE

- A. Piping enclosure shall be supplied by the manufacturer factory assembled and shall be of the same construction as the main unit casing. Piping cabinet shall be external to the unit and be shipped separate for field installation in order to facilitate piping of the unit coil(s). Piping cabinet to cover unit sections as specified on schedule and shall have be provided with access door(s).

2.10 FILTERS

- A. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter sections shall have filter guides and full height, double-wall, hinged doors for filter removal. Construct doors in accordance with Article 2.04 Paragraph C. Filter sections shall flange to other unit components. Provide filter blockoffs as required to prevent air bypass around filters.

2.11 DAMPERS

- A. Provide internally mounted ultra low leak dampers as scheduled on drawings. Dampers shall be Ruskin CD60 double skin airfoil design or equivalent. Construct damper blades and damper frames of galvanized steel. Provide compressible jamb seals and extruded vinyl blade edge seals. Blades shall rotate on stainless steel sleeve bearings. Damper blade lengths shall not exceed 60 inches. Leakage rate shall not exceed 3 CFM/square foot at one inch water gage and be AMCA licensed as a Class 1A damper. All Leakage testing and pressure ratings will be based on AMCA Publication 500.

2.12 FACTORY-INSTALLED STARTER / LINE BREAK SWITCH

- A. Provide IEC or NEMA Type Combination Starter / Line Break Switch for each fan motor. Each shall be properly sized, mounted, wired and commissioned by the AHU manufacturer. Package shall include line break switch, control transformer, Hands-Off-Auto (H-O-A) switch, N.O. auxiliary contact, electronic overloads (factory-set for the specific motor). Units with factory-mounted controls shall also include power wiring from the starter control transformer to the control system transformers, and start-stop wiring from the controller start-stop relay to the starter H-O-A switch. Wiring methods must comply with the National Electric Code and NFPA 70. Factory mounting will facilitate temporary heating, cooling, ventilation, and / or timely completion of the project.
- B. ENCLOSURE: Starter / Line Break Switch shall have full metal enclosures. Enclosures shall be weather tight and completely recessed inside the standard unit casing. The door should be identical construction to the access doors on the air handler. A manual shut down switch shall be located on the outside of the access door.
- C. FACTORY MOUNTING: Starter / Line Break Switch shall be factory mounted on the drive side of the air handling unit fan section. Ensure four feet of clearance from the side of the air handler.

- D. **FACTORY WIRING:** Starter / line break switches shall be wired to fan motor per required NEC, UL, and NFPA 90 requirements. Units with factory mounted controls shall also include power wiring from the starter control transformer to the control system transformers. Also a binary start-stop signal shall be wired complete from the direct digital controller to the starter.
- E. **FACTORY COMMISSIONING:** Trained factory personnel shall ensure proper operation of the starter by a thorough factory test. Fuses and overload heaters must be selected individually for the voltage, horsepower, and full load amps of the actual motor being supplied. Testing shall include a "Hypot" test of unit wiring to insure that no weaknesses exist in starter, wiring, or motor. "Hand" and "Auto" positions shall be verified to insure starter is operational.

2.13 FACTORY-INSTALLED VARIABLE FREQUENCY DRIVE / LINE BREAK SWITCH

- A. Combination Variable Frequency Drive / line break switches shall be properly sized, mounted, wired to the fan motor, and commissioned by the AHU manufacturer. Combination VFD / line break switches shall include the VFD, a circuit breaker disconnect, a Drive-Off (H-O-A) switch, manual speed control dial, and a control transformer. Factory mounting will facilitate temporary heating, cooling, ventilation, and / or timely completion of the project.
- B. **VARIABLE FREQUENCY DRIVES:** The VFD shall be a high performance pulse width modulated (PWM) AC drive that generates a sine-code, variable voltage/frequency, three phase output for optimum speed control. The inverter section shall utilize only intelligent power modules (IPM's) to generate an 8kHz PWM output to ensure a low audible magnetic motor noise (@ 60 Hz) of less than 2 dB (@ 1 meter) above across the line operation. Power electronics shall provide at least 96% efficiency. The VFD shall be digitally based using a common microprocessor control logic circuit board for the horsepower ratings. All programming shall be maintained in non-volatile RAM memory so the program will be maintained when power is removed. A digital operator keypad and display shall provide local control and readout for: run/stop, speed, reset, volts, amps, kilowatts, and diagnostics. Output current overload should be rated at 110% of motor FLA for one minute. The VFD shall have the following minimal protective features: current limited stall prevention, auto restart after momentary power loss, speed search for starting into rotating motor, anti-windmill w/DC injection before start, phase-to-phase short circuit protection, and ground fault protection. Ambient service temperature rating of -10 to 50 degrees C, and humidity rating to 95% non-condensing. The VFD shall be UL508C listed and CSA certified and shall conform to applicable NEMA, ICS, NFPA, IEC, AND ISO 9001 standards.
- C. **ENCLOSURE:** VFD / Line Break Switch shall have full metal enclosures. Enclosures shall be weather tight and completely recessed inside the standard unit casing. The door should be identical construction to the access doors on the air handler. A manual shut down switch shall be located on the outside of the access door.
- D. **FACTORY-MOUNTING:** VFD/Disconnect shall be factory-mounted on the drive side of the air handling unit fan section. Ensure four feet of clearance to access panel.
- E. **FACTORY WIRING:** VFD / disconnects shall be wired to fan motor per required NEC, UL, and NFPA 90 requirements. Units with factory mounted controls shall also include power wiring from the VFD control transformer to the control system

transformers. Also a binary start-stop signal and an analog speed signal shall be wired complete from the direct digital controller to the VFD.

- F. **FACTORY COMMISSIONING:** Trained factory personnel shall ensure proper operation of the VFD by a thorough factory test. Testing shall include "Hypot" test of unit wiring to insure that no weaknesses exist in VFD, wiring, or motor. VFD should be energized and fan run at 22Hz, 40Hz, and 60Hz to insure VFD will operate throughout usable range of drive and that the fan rotation is correct. If VFD has bypass, fan will additionally be tested in bypass position to insure bypass is operational.

2.14 ROOF CURBS

- A. Roof curbs are specified in Division 23 Section "Vibration Controls for HVAC Piping and Equipment."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. **Roof Curb:** Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing.
- B. Arrange installation of units to provide access space around air-handling units for service and maintenance.
- C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.
- D. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide

filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

3.3 CONNECTIONS

- A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect duct to air-handling units with flexible connections. Comply with requirements in Division 23 Section "Air Duct Accessories."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. HEPA-Filter Operational Test: Pressurize housing to a minimum of 3-inch wg or to designed operating pressure, whichever is higher; test housing joints, door seals, and sealing edges of filter with soapy water to check for air leaks.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that shipping, blocking, and bracing are removed.
 - 3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
 - 4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
 - 5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
 - 6. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
 - 7. Verify that proper thermal-overload protection is installed for electric coils.

8. Install new, clean filters.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 237313

SECTION 238239 - UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Propeller unit heaters with hot-water coils.

1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. CWP: Cold working pressure.
- C. PTFE: Polytetrafluoroethylene plastic.
- D. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
- B. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Cabinet Unit Heater Filters: Furnish one spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.1 PROPELLER UNIT HEATERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Engineered Air.
 - 2. Rittling, a div. of Hydro-Air Components.
 - 3. Trane.
- C. Description: An assembly including casing, coil, fan, and motor in vertical and horizontal discharge configuration with adjustable discharge louvers.
- D. Comply with UL 2021.
- E. Comply with UL 823.
- F. Cabinet: Removable panels for maintenance access to controls.
- G. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.
- H. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- I. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.
- J. General Coil Requirements: Test and rate hot-water propeller unit heater coils according to ASHRAE 33.
- K. Hot-Water Coil: Copper tube, minimum 0.025-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 325 deg F, with manual air vent. Test for leaks to 350 psig underwater.
- L. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

- M. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Type: Permanently lubricated,.
- N. Control devices and operational sequences are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before unit heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07 Section "Joint Sealants."
- B. Install cabinet unit heaters to comply with NFPA 90A.
- C. Install propeller unit heaters level and plumb.
- D. Suspend cabinet unit heaters from structure with elastomeric hangers. Vibration isolators are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- E. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
- F. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

- D. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
- E. Comply with safety requirements in UL 1995.
- F. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of unit heater. Hydronic specialties are specified in Division 23 Section "Hydronic Piping."
- G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

- A. Adjust initial temperature set points.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 238239

SECTION 238500 – DUST AND FUME COLLECTOR AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
1. Welding fume, smoke, and dust collection systems

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
1. Certified fan performance curves with system operating conditions indicated.
 2. Certified fan sound-power ratings.
 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 4. Material thickness and finishes, including color charts.
 5. Dampers, including housings, linkages, and operators.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Wiring Diagrams: Power, signal, and control wiring.
 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.6 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.7 EXTRA MATERIALS

- 1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 DUST COLLECTOR

- A. Manufactures (Refer to Bid Form for applicable base bid and alternate manufacturers):
 - 1. Base Bid:
 - a. Airex
- B. Performance including airflow capacity, filter media area, fan external static pressure, and fan motor horsepower shall be as indicated on the drawings.

- C. Description: Cartridge dust collector with pulse cleaning, pad mounted backward inclined airfoil fan with inlet cone and silencer, and high-efficiency cartridge filters (99.99% efficient at 0.5 microns).
- D. Dust collector shall be a self cleaning vertical cartridge type complete with filters, backward inclined blower and inter-connecting duct with external discharge silencer.
- E. Dust collector construction shall be of minimum 10 gauge fully welded steel construction with steel frame and tube sheet. The collector consists of a single filter module with (2) 60 degree hoppers with support stand.
- F. Dust collector to include (24) 315 sq. ft. vertical cartridge type filters manufactured from NANOFIBER with a class 2 fire retardant coating. Cartridges to have an efficiency of 99.999% @ 0.5 micron. Air to cloth ratio shall not exceed 1.99 to 1. Horizontal / semi horizontal filter configuration dust collectors not acceptable. Cartridge filters shall be accessed through quick opening access doors. No tools shall be required for removal of cartridges. Doors shall be heavy duty formed steel with mechanically attached seal.
- G. Dust collector shall be provided with an integrated timer and motor controller in a NEMA 12 enclosure for field installation inside the welding shop. Included shall be IEC solid state overload protection, start/stop/reset buttons, LED run indication, transformer for 120/1/60 VAC control voltage, digital pulse timer controller, on demand and continuous cleaning options via photohelic gauge (0-15" H₂O) and main rotary disconnect and fuse block sized to match horsepower. Motor starter shall be a variable frequency drive and allow for a setting interface of 50% or 100%. Plastic tubing line sets to be ran from photohelic to taps on dust collector by HVAC contractor.
 - 1. Control panel shall include control circuit contactors for fire alarm and suppression shut-down.
- H. Dust collector shall be provided with a (50) hp belt drive non overloading backward inclined exhaust fan, mounted on the ground beside the dust collector. Blower to be AMCA C construction and to include unitary base, and OSHA belt guards. Motor shall be TEFC type. Inter-connecting duct from the blower inlet to the dust collector outlet, same gauge metal as collector shall also be provided by the dust collector manufacturer. A manually operated outlet damper shall also be included. Blower and inter-connecting duct shall be painted to match the collector. Blower to be rated for 15,000 cfm @ 13" TSP.
- I. Dust Collector shall be provided with an external discharge silencer 42" x 42" x 96" long painted to match the dust collector.
 - 1. Silencer will be installed in fan discharge ductwork by the HVAC Contractor. Ductwork between fan and silencer shall be by the HVAC Contractor.
- J. Dust collector shall include a reverse pulse cleaning system with venturi assistance. Included are blow pipes, internal piping, compressed air header, solenoid valves and diaphragm valves. The diaphragm valves shall be a minimum 1 ½" diameter. Venturi to be of spun steel type.
- K. Dust Collector shall be provided with a fire kit consisting of thermal heat sensor on the filter section of the collector and sprinkler piping in the hopper section of the collector. Heat sensor shall be field wired by contractor to the main control panel of

the collector and will shut down the dust collector in the event of sensing temperature rise.

1. Fire suppression head and external suppression piping will be field installed by the Plumbing Contractor
- L. Dust collector shall be provided with drum covers, flex hose, clamps and two 55 gallon drums for dust storage.
- M. Dust collector to be provided with inlet duct connection within hopper at low entry point with semi circle baffle and end target plate.
- N. Dust collector shall be painted with 1 coat of primer and 2 coats of polyurethane for minimum of 3 mil thickness. All carbon steel components shall be acid washed prior to painting. Unit shall be painted Airex standard grey.
- O. Dust collector to have 3/4" standard NPT coupling for compressed air.
- P. Dust collector to be provided with a remote mounted point of use desiccant air dryer and coalescer, complete with regulator, gauge and moisture indicator

2.2 WELDING FUME EXTRACTORS

Manufactures:

- a. Henlex model V6-A-05-2R-NC-CV-JO-WB
- B. Source capture arm shall consist of a wall mounted arm complete with wall mounting bracket and capture hood.
- C. Source capture arm to be a 6" x 5' and to include the following;
 1. Arm assembly to be constructed with (2) cast aluminum friction joints. Friction joint tension is adjustable by using external handle to compress a compression spring on a thrust bearing.
 2. Arm assembly to include source capture hood with 360 degree rotating ball joint type joint and handle.
 3. Source capture arm to include butterfly damper
 4. Source capture arm to include wall mounting bracket. Wall mounting bracket to be equipped with a dielectric union to insulate the arm from ground to prevent welding on the arm.
 5. Source capture arm to be constructed from 6" aluminum tube, .100" thick.

2.3 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install dust collectors level and plumb.
- B. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 1 inch. Vibration-control devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."
- C. Install units with clearances for service and maintenance.
- D. Label units according to requirements specified in Division 15 Section "Mechanical Identification."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 16 Section "Grounding and Bonding."
- D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Engage a factory authorized service agent to perform inspection, testing, and start-up. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. 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.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. 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.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.

- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

3.5 TRAINING

- A. Engage a factory authorized service agent to provide two on-site training session for dust collection unit, minimum 4 hours per session.
- B. Engage a factory authorized service agent to provide two on-site training sessions for fume extractor arms, minimum 1 hour per session.
 - 1. Provide instruction on recommended positioning of fume extractor hood for optimal performance.

END OF SECTION 238500

**SECTION 260519-LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS
AND CABLES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpha Wire.
 - 2. Belden Inc.
 - 3. Encore Wire Corporation.
 - 4. General Cable Technologies Corporation.
 - 5. Southwire Incorporated.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

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- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for, Type XHHW-2, and Type SOW.
- D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC, and Type SOW with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Gardner Bender.
 - 3. Hubbell Power Systems, Inc.
 - 4. Ideal Industries, Inc.
 - 5. IlSCO; a branch of Bardes Corporation.
 - 6. NSi Industries LLC.
 - 7. O-Z/Gedney; a brand of the EGS Electrical Group.
 - 8. 3M; Electrical Markets Division.
 - 9. Tyco Electronics.

- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 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 NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type XHHW-2, single conductors in raceway.

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- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
- D. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type XHHW-2, single conductors in raceway or metal-clad cable, Type MC.
- F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
- G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. 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." Cord drops shall have wire mesh supports at either end of cord.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-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.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

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3.5 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.

3.6 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."

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.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Earth grounds, including perimeter grounds.
 - 2. Bonds to structure.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. Dossert; AFL Telecommunications LLC.

3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
- 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.

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. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 1/2 inch by 10 feet.

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. 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 Structural Steel: Welded connectors.
- C. Grounding Bus: Install in welding booths, at each piece of welding equipment, and elsewhere as indicated on the drawings.
 - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 48 inches above finished floor unless otherwise indicated.
 - 2. Final location of bus shall be coordinated with the Owner, other equipment in the space or booth.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus at the service entrance.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.

3.4 EQUIPMENT GROUNDING

- A. Install dedicated insulated equipment grounding conductors with all feeders and branch circuits.

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 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 and as otherwise indicated. Make connections without damaging coating if any steel structure.

- C. 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. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
 - 3. Minimum strap or jumper size shall be #8 AWG.
- D. Grounding and Bonding for Piping:
 - 1. In the Welding Shop bond each aboveground portion of gas or air piping system downstream from equipment shutoff valve and in the ceiling.
- E. Grounding and Bonding for duct work and HVAC equipment:
 - 1. In the Welding Shop bond each aboveground portion of air duct system downstream from equipment, bond sections of metal duct together where sections of flex duct or non-metal duct work are provided.
 - 2. Bond HVAC equipment to welding shop ground electrode.
 - 3. Bond HVAC controls, motor starters and disconnects to welding shop ground electrode.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner.
- G. Provide continuous perimeter grounding electrode as indicated.
 - 1. See drawings and Electrical Notes on E0.2 for additional requirements.

3.6 FIELD QUALITY CONTROL

- A. 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. Prepare dimensioned Drawings locating each test well and grounding electrode. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529-HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.

3. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 2. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 3. Channel Dimensions: Selected for applicable load criteria.
- 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.
 - a. Cord drops:
 - 1) Wire mesh secured to structure above and to cord, 12" coiled and secured loop at support to allow for future cord length adjustments, vertical drop to plug directly below.
 - 2) Wire mesh secured to plug or receptacle and cord, plug or receptacle mounted 5' above finish floor, or as directed.
- C. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

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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.
2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with single-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. 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.

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- C. 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 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 meet seismic-restraint strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in 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 or higher as required. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete." Or Section 033053 "Miscellaneous Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINING

- A. Wall mounted hangers and supports shall be custom painted to match adjacent surface in existing finished spaces. Comply with interior painting requirements of Division 9.
- B. 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.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533-RACEWAYS AND BOXES 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. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Surface raceways.
- B. Related Requirements:
 - 1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. 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.
- B. GRC: Comply with ANSI C80.1 and UL 6.

- C. IMC: Comply with ANSI C80.6 and UL 1242.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew or compression.
 - 2. 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.
- H. Joint Compound for IMC or GRC: 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 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic 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.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, 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.
- B. Fittings and Accessories: Include hinged 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.
- C. Wireway Covers: Continuously hinged-cover type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. 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: GRC. Raceway locations include the following, below 10'AFF:
 - a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - b. Electrical or Mechanical rooms.
 - c. Storage Rooms.
 - d. Shops.
 - e. Receiving rooms.
 4. Exposed in the Multipurpose room ceiling: EMT, painted to match adjacent surface.
 5. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 7. Damp or Wet Locations: GRC or IMC.
 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in damp or wet locations.
 9. Boxes and Enclosures exposed vandalism: Cast aluminum, deep box in the following areas below 8':
 10.
 - a. Classrooms.
 - b. Theory rooms.
 - c. Other student occupied spaces, not noted below.
 11. Boxes and Enclosures exposed subject to severe physical damage: Malleable Iron, deep box in the following areas below 16':
 12.
 - a. Shops.
 - b. Receiving areas.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. 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 setscrew or 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.

D. Install surface raceways only where indicated on Drawings.

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 NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Exposed boxes and conduits in existing finished spaces shall be painted to match the surface they are mounted on.
- C. Exposed conduits in shops or receiving areas shall use GRC up to 16 feet above finished floor.
- D. Exposed device boxes in finished space shall use cast metal boxes with up to 8 feet above finished grade.
- E. 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.
- F. Complete raceway installation before starting conductor installation.
- G. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Raceways in exposed ceilings:
 1. Run conduits snug to the upper roof joist support.
 2. Run conduits parallel and perpendicular to roof joists.
- L. 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 2 inches of concrete cover in all directions.
 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- M. Stub-ups to Above Recessed Ceilings:
1. Use EMT, IMC, or RMC for raceways.
 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- N. 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.
- O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- P. 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.
- Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- R. 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.
- S. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- T. 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. Label as spare.
- U. 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.
- V. 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. Install raceway sealing fittings according to NFPA 70.

- W. 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.
 - X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
 - Y. Expansion-Joint Fittings:
 - 1. 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.
 - 2. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
 - Z. 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.
 - 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.
- 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. Comply with requirements in Section 078413 "Penetration Firestopping."
- 3.5 PAINTING
- A. Wall mounted boxes and conduits shall be custom painted to match adjacent surface in existing finished spaces. Comply with interior painting requirements of Division 9.

3.6 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 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. Identification of power and control cables.
 - 2. Identification for conductors.
 - 3. Warning labels and signs.
 - 4. Instruction signs.
 - 5. Equipment identification labels.
 - 6. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI 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. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.3 FLOOR MARKING TAPE

- A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Warning label and sign 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."

2.5 INSTRUCTION SIGNS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- C. See detail drawings for additional requirements.

2.7 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black except where used for color-coding.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. 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 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.

- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags.
- B. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- C. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. 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.
- D. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- E. 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.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:

- a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. 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. Label shall indicate downstream equipment ID, room name and number, voltage and phase.
 - b. Distribution Breakers: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/4-inch-high letters on 1-inch-high label; where three lines of text are required, use labels 2 inches high. Label shall indicate down stream equipment ID, room name and number.
 - c. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - d. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - e. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment to Be Labeled:
- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer.
 - b. Panelboard distribution breakers.
 - c. Enclosures and electrical cabinets.
 - d. Emergency system boxes and enclosures.
 - e. Enclosed switches.
 - f. Enclosed circuit breakers.
 - g. Enclosed controllers.
 - h. Variable-speed controllers.

END OF SECTION 260553

SECTION 262416-PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
- B. Work in this section shall be commissioned by this contractor. Commissioning will be supervised by an independent agent hired by the Owner. See Section 260113, "Commissioning of Electrical Systems."
- C. See Electrical Alternate.

1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 6. Include wiring diagrams for power, signal, and control wiring.

7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems." Include the following:
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 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. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

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. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
 - B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
 - C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
 - D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - E. Comply with NEMA PB 1.
 - F. Comply with NFPA 70.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Handle and prepare panelboards for installation according to NECA 407.
- 1.10 COORDINATION
- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (see Electrical Alternate):
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. ABB, formerly General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Enclosures: Flush- and surface-mounted cabinets.
 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

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2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 3. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- D. Incoming Mains Location: Top and bottom.
- E. Phase, Neutral, and Ground Buses:
1. Material: Tin-plated aluminum or hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- F. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Tin-plated aluminum or hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Mechanical type.
 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 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."

2.3 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, power and feeder distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.

- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- F. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker or lugs only.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - 3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

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- a. Standard frame sizes, trip ratings, and number of poles.
- b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
- c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
- d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
- e. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
- f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.

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1. Set field-adjustable, circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Acceptance Testing Preparation:
 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- C. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION 262416

SECTION 262500 - ENCLOSED BUS ASSEMBLIES

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. Plug-in bus assemblies.
 - 2. Fused bus plug-in devices.

1.3 DEFINITIONS

- A. kAIC: kiloampere interrupting capacity.
- B. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: For each type of product.
 - 1. Show fabrication and installation details for enclosed bus assemblies. Include plans, elevations, and sections of components. Designate components and accessories, including clamps, brackets, hanger rods, connectors, straight lengths, and fittings.
 - 2. Show fittings, materials, fabrication, and installation methods.
 - 3. Indicate required clearances, method of field assembly, and location and size of each field connection.
 - 4. Cable and conductor terminal sizes for bus and plug-in device terminations.
 - 5. Wiring Diagrams: Power wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and sections, drawn to scale. Include scaled bus-assembly layouts and relationships between components and adjacent structural, mechanical, and electrical elements. Show the following:
 - 1. Vertical and horizontal enclosed bus-assembly runs, offsets, and transitions.
 - 2. Clearances for access above and to the side of enclosed bus assemblies.
 - 3. Vertical elevation of enclosed bus assemblies above the floor or bottom of structure.

4. Support locations, type of support, and weight on each support.
5. Location of adjacent construction elements including luminaires, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed bus assemblies to include in emergency, operation, and maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle enclosed bus assemblies according to NEMA BU 1.1, "General Instructions for Handling, Installation, Operation, and Maintenance of Busway Rated 600 Volts or Less."

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

- A. Source Limitations: Obtain enclosed bus assemblies and plug-in devices from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 857.

2.2 ENCLOSED BUS ASSEMBLIES

- A. Plug-in Bus Assemblies: Low-impedance bus assemblies in totally enclosed, nonventilated housing; single-bolt joints; ratings as indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eaton.
 - b. General Electric Company; GE Energy Management - Electrical Distribution.
 - c. SIEMENS Industry, Inc.; Energy Management Division.
 - d. Square D; by Schneider Electric.
 2. Electrical Characteristics:
 - a. Voltage: as indicated.

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- b. Phase: Three phase, 4 wire, plus ground, unless indicated otherwise.
 - c. Percent of Neutral Capacity: 100.
3. Short-Circuit Interrupting Rating: 45kAIC.
 4. Temperature Rise: 55 deg C above 40 deg C ambient maximum for continuous rated current.
 5. Bus Materials: Current-carrying aluminum conductors (unless noted otherwise), fully insulated with Class 130C insulation except at stabs and joints; plated surface at stabs and joints.
 6. Ground: 50 percent capacity.
 7. Enclosure: Steel, with manufacturer's standard finish.
 8. Plug-in Openings: 24 inches o.c. on each side of bus, and hinged covers over unused openings. Plug-in openings shall be finger-safe with covers open or closed.
 9. Fittings and Accessories: Manufacturer's standard.
 10. Mounting: Arranged flat, edgewise, or vertically without derating. Rated for hanger spacing of up to 10 feet for horizontally mounted runs and up to 16 feet for vertically mounted runs.
- B. Joints:
1. Busway joints shall use one high-strength steel bolt with Belleville washers.
 2. Bolts shall be torque indicating type and at ground potential.
 3. Bolts shall be two-headed design to indicate when proper torque has been applied and require only a standard long handle wrench to be properly activated.
 4. Access shall be required to only one side of the busway for tightening joint bolts.
 5. Joint connection assemblies that rely on the joint cover to provide ground continuity are unacceptable.

2.3 PLUG-IN DEVICES

- A. Fusible Switches: NEMA KS 1, heavy duty; with R-type fuse to accommodate specified fuses; hookstick-operated handle, lockable with two padlocks, and interlocked with cover in closed position. Interlocked to prevent plug-in device insertion into or removal from bus with switch in closed position. See Section 26 2813 "Fuses" for fuses and fuse installation requirements.
- B. Accessories:
1. One hookstick operator per bus shown on the drawings, adjustable to maximum extension of 14 feet. Locate hookstick on wall adjacent to bus, provide mounting hardware for hookstick.
 2. Cord and grip for each plug-in device to allow for operation of switch from below.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate layout and installation of enclosed bus assemblies and suspension system with other construction that penetrates ceilings or floors or is supported by them, including luminaires, HVAC equipment, fire-suppression system, and partition assemblies.

- B. Support bus assemblies independent of supports for other elements such as pipes, conduits, ceilings, and ducts.
 - 1. Design each fastener and support to carry 200 lb or 4 times the weight of bus assembly, whichever is greater.
 - 2. Support bus assembly to prevent twisting from eccentric loading.
 - 3. Support bus assembly with not less than 3/8-inch steel rods. Install side bracing to prevent swaying or movement of bus assembly. Modify supports after completion to eliminate strains and stresses on bus bars and housings.
 - 4. Fasten supports securely to building structure according to Section 26 0529 "Hangers and Supports for Electrical Systems."
 - 5. Bolts and nuts that are loosened for any reason after tightening to manufacturer's recommended torque setting shall be discarded and replaced with new bolts and nuts.
- C. Coordinate bus-assembly terminations to equipment enclosures to ensure proper phasing, connection, and closure.
- D. Tighten bus-assembly joints with torque wrench or similar tool recommended by bus-assembly manufacturer. Tighten joints again after bus assemblies have been energized for 30 days.
- E. Install bus-assembly, plug-in units. Support connecting conduit independent of plug-in unit.
- F. Comply with NECA 1.

3.2 CONNECTIONS

- A. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 26 0519 "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.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing equipment test, for compliance with requirements according to NETA ATS.
 - 2. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with Drawings and Specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, and grounding.
 - d. Verify correct connection according to single-line diagram.

- e. Inspect bolted electrical connections for high resistance using one or more of the following methods:
 - 1) Use of low-resistance ohmmeter.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
 - 3) Perform thermographic survey.
 - 3. Electrical Tests:
 - a. Perform insulation resistance measurements through bolted connections and bus joints with low-resistance ohmmeter.
 - b. Perform insulation resistance tests of each busway, phase to phase, and phase to ground.
 - c. Perform a dielectric withstand voltage test on each busway, phase to ground with phases not under test grounded for one minute.
 - d. Measure resistance of assembled busway sections on insulated busway and compare values with adjacent phases.
 - e. Perform phasing test on each busway tie section energized by separate sources.
 - f. Verify operation of busway space heaters.
 - C. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
 - 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
 - D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.
 - E. Enclosed bus assemblies will be considered defective if they do not pass tests and inspections.
 - F. Prepare test and inspection reports.
- 3.4 CLEANING
- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262500

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.
- B. Electrical Notes on Drawing E002 for additional requirements.

1.2 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Weather-resistant receptacles.
 - 3. Snap switches.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.5 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.7 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Leviton Manufacturing Co., Inc.
 - 3. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. See Electrical Notes on E000. Where requirements are more stringent, comply with the more stringent requirements. Where other types of wiring devices are indicated in the Electrical Notes, provide devices as indicated.
- B. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. 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 the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2.4 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, non-feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
 - 4. Self testing.

2.5 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A.

2.6 WALL PLATES

- A. 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: 0.035-inch-thick, satin-finished, Type 302 stainless steel.
 - 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.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.7 FINISHES

- A. 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 Emergency Power System: Red.

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 meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- 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 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. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use clear adhesive labels with machine printed black text on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is 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.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - FUSES

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. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Control circuits.
 - b. Motor-control centers.
 - c. Enclosed controllers.
 - d. Enclosed switches.
 - 2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in PDF format.
 - 5. Coordination charts and tables and related data.
 - 6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in include the following:
1. Ambient temperature adjustment information.
 2. Current-limitation curves for fuses with current-limiting characteristics.
 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in PDF format.
 4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than 3 of each size and type.
 2. Locate in spare-fuse cabinet.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bussmann; Eaton, Electrical Sector.
 2. Littelfuse, Inc.
 3. Mersen USA.
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, blown-fuse indicator, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.

- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
 - 4. Fuse Pullers: Two for each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Feeders: Class L, time delay, Class RK1, time delay, or Class J, time delay.
 - 2. Motor Branch Circuits: Class RK5, time delay.
 - 3. Control Transformer Circuits: Class CC, time delay, control transformer duty.
 - 4. Other Branch Circuits: Class RK1, time delay.
 - 5. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet as coordinated in the field with Owner.

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816-ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Fusible switches, see Electrical Alternate.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1. Enclosure types and details for types other than NEMA 250, Type 1.
 2. Current and voltage ratings.
 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, 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.
- B. Field quality-control reports.
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- 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 (see Electrical Alternate):
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. ABB, formerly General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 4. Lugs: Mechanical type, suitable for number, size, and conductor material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- B. Tests and Inspections:

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- 3.5 ADJUSTING
- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

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 lighting fixtures, lamps, and drivers.
- 2. Exit signs.
- 3. Lighting fixture supports.

- B. Related Sections:

- 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
- 2. Section 260943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
- 3. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. LED: Light emitting diode.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Energy-efficiency data.
3. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
4. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. **Manufacturer Certified Data:** Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. **Operation and Maintenance Data:** For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

A. **Luminaire Photometric Data Testing Laboratory Qualifications:** Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

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

C. Comply with NFPA 70.

1.8 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Source: LED type with integral driver, unless drawings indicate otherwise.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- E. 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.
- F. 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 indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.

2.3 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. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with 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 fixture.

- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install drawings depicted on electrical drawings and architectural drawings. Where in conflict submit request for information to the architect for clarification.
- B. Lighting fixtures:
1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 2. Install lamps in each luminaire.
- C. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- D. Remote Mounting of Drivers: Distance between the drivers and fixture shall not exceed that recommended by driver manufacturer. Verify maximum distance with manufacturers.
- E. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
1. Install ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- F. Suspended Lighting Fixture Support:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
 - 1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

SECTION 265119 - LED 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 the various types of LED luminaires scheduled on the Drawings:
- B. Related requirements include lighting control devices and systems. Each luminaire shall be compatible with its controlling devices or system.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. 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, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project, IES LM-79 and IES LM-80.

- 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.
 - B. 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.
 - C. Product Schedule: For luminaires and lamps.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Custom Drawings: Where indicated for rows of suspended linear luminaires, provide custom row drawings indicating manufactured units, end caps, joining hardware, suspension locations and types, and wiring diagrams with feed points and joining details.
 - B. Qualification Data: For testing laboratory providing photometric data for luminaires.
 - C. Product Test Reports: For each luminaire.
- 1.6 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.
- 1.9 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 LUMINAIRE REQUIREMENTS

- A. See Luminaire Schedule on the Schedule drawings.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Standards:
 - 1. UL Listing: Listed for damp location.
 - 2. Recessed luminaires shall comply with NEMA LE 4.
- D. CRI of minimum 70, CCT of 3500 K, unless noted otherwise
- E. Rated lamp life of 60,000 hours to L70 or better.
- F. Lamps dimmable from 100 percent to 0 percent of maximum light output where indicated.
- G. Internal driver.
- H. Nominal Operating Voltage: as indicated.
- I. Housings: as specified.

2.2 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. 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.
- C. Diffusers and Globes:
 - 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. 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.

2.3 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.

2.4 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 A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

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. 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 vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to a minimum 20 gauge backing plate attached to wall structural members.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. 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.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
4. Connect support wires or rods to building structure.

H. 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."
- B. Identify each luminaire with a panel and circuit ID printed label on the face, in the corner, of the luminaire.

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.
 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to generator power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

- C. Prepare test and inspection reports.

3.6 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 271500-COMMUNICATIONS HORIZONTAL CABLING

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. UTP cabling.
 - 2. Cable connecting hardware, patch panels, and cross-connects.
 - 3. Telecommunications outlet/connectors.
 - 4. Cabling system identification products.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. LAN: Local area network.
- G. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- H. RCDD: Registered Communications Distribution Designer.
- I. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For layout technician and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 - 2. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
 - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.

2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Splitters shall not be installed as part of the optical fiber cabling.

- B. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Grounding: Comply with J-STD-607-A.

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. See Electrical Notes on Drawing E0.2.
- B. Description: 100-ohm, four-pair UTP, covered with a blue, or as directed, thermoplastic jacket.
1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 3. Comply with TIA/EIA-568-B.2, Category 6A.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

2.4 UTP CABLE HARDWARE

- A. See Electrical Notes on Drawing E0.2 for additional requirements. Where drawing is more stringent, comply with drawing.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Leviton Commercial Networks Division.
- C. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

- D. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- E. Patch Panel: QuickPort, open type with keystone jacks for each cable termination, housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - 1. Number of Jacks per Field: One for each four-pair UTP cable indicated.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, four-pair cables in lengths suitable for installed conditions with not more than 1' slack, terminated with eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6A performance. Patch cords shall have latch guards to protect against snagging.
 - 2. Patch cords shall have color-coded boots for circuit identification.

2.5 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: Three-port-connector assemblies mounted in single or multigang faceplate.
 - 1. Metal Faceplate: Stainless steel, complying with requirements in Section 262726 "Wiring Devices."
 - 2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
 - a. Flush mounting jacks.
 - 3. Legend: Machine printed, in the field, using adhesive-tape label.
 - 4. See Electrical Notes on E0.2 and details for additional requirements.

2.6 GROUNDING

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with J-STD-607-A.

2.7 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.8 SOURCE QUALITY CONTROL

- A. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements in Section 270536 "Cable Trays for Communications Systems."
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 - 2. Install lacing bars and distribution spools.
 - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.

4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 10. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
 11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
- D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Provide Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable,

jacks, connectors, and terminals to which it connects with same designation. At completion, cable and drawings shall reflect as-built conditions.

- C. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings.
- E. Cable and Wire Identification:
 - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
 - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.

3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. UTP Performance Tests:
 - a. Test for each outlet. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.
 - B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
 - C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
 - D. Prepare test and inspection reports.

END OF SECTION 271500

SECTION 323110 – CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. PVC coated chain link fabric on PVC coated galvanized framework.
2. Swing gates.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes the following:
 - a. Fence and gate posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
 - c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Qualification Data: For factory-authorized service representative.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Master Halco.
 2. Merchants Metals.
 3. Pro Max Fence Systems.

2.2 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to “CLFMI Product Manual” and requirements indicated below:
1. Fence Height: As indicated on drawings, measured from finished grade to top of fabric. Bottom of fabric shall be not more than 3/4-inch above finished grades.
 2. Steel Wire for Fabric: Wire diameter of 0.148-inch (9-gage).
 - a. Mesh Size: 2-inch mesh.
 - b. Galvanized Steel Finish: ASTM A 392, Class 2, 2.0 oz./sq.ft. zinc coating.
 - c. Polyvinyl Chloride (PVC) Coated Fabric: ASTM F 668, Class 2b, over zinc-coated steel wire.
 - 1) Color: Black, complying with ASTM F 934.
 3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAME WORK

- A. Steel Framework, General: Posts, rails, and braces.

1. Pipe Material: Type I, hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight schedule 40 with not less than 1.8 oz. zinc per sq. ft. of surface area coated.
 2. Polyvinyl Chloride (PVC) Finish: Provide framework, fittings, and accessories with a ASTM F 1043 PVC thermally fused color coating, minimum thickness 10 mils (0.010-inch) thick.
 - a. Color: Match chain link fabric.
- B. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
1. Line Posts: Based on fabric height as follows:
 - a. Up to 6 Feet High: 1.900 inch OD steel pipe, 2.72 lb/ft.
 - b. 6 Feet to 8 Feet: 2.375 inch OD steel pipe, 3.65 lb/ft.
 2. Terminal Posts (End, Corner): Based on fabric height as follows:
 - a. Up to 6 Feet High: 2.375 inch OD steel pipe, 3.65 lb/ft.
 - b. 6 Feet to 8 Feet: 2.875 inch OD steel pipe, 5.79 lb/ft.
 3. Horizontal Framework Members: Top and bottom rails and braces according to ASTM F 1043.
 - a. Top Rails, Bottom Rails and Braces: 1.660 inch OD steel pipe, 2.27 lb/ft.

2.4 GATES

- A. Fabrication: Fabricate perimeter frames of gates from metal and galvanized with black vinyl coated finish. Assemble gate frames by welding. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members maximum of 8 feet apart unless otherwise indicated.
1. Provide steel fabric as for gates unless otherwise indicated. Install fabric with tension bars and bands at vertical edges and at top and bottom edges.
 2. Install diagonal cross-bracing consisting of 3/8-inch diameter adjustable-length truss rods on gates to ensure frame rigidity without sag or twist.
- B. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
1. 6 Feet to 12 Feet: 4.00 inch OD steel pipe, 9.11 lb/ft.

- C. Swing Gates: Comply with ASTM F 900.
1. Fabricate perimeter frames of minimum 1.875-inch OD steel pipe.
 2. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:
 - a. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180-deg gate opening. Provide 1-1/2 pair of hinges for each leaf over 6-foot nominal height.
 - b. Latch: Forked type or plunger-bar type to permitting operation from both sides of gate with padlock eye as integral part of latch. Padlock specified under Division 8 Section "Door Hardware".
 - c. Double Gates: Provide galvanized drop rod with center gate stop pipe or receiver to secure inactive leaf in the closed position. Provide galvanized pressed steel locking latch, requiring one padlock for locking both gate leaves, accessible from either side.
 - d. Gate Stops: Provide gate stops for double gates consisting of mushroom-type flush plate with anchors, set in concrete and designed to engage a center drop rod or plunger bar. Include a locking device and padlock eyes as an integral locking device and padlock eyes as an internal part of the latch permitting both gate leaves to be locked with a single padlock.

2.5 FITTINGS

- A. Fitting Materials: Comply with ASTM F 626. Galvanized iron or steel, to suit manufacturer's standards.
1. PVC Coating: All fittings and accessories shall be polyvinyl coated same as specified for fabric and framing members. PVC coating shall be fused to the surface.
- B. Wire Ties: 9-gage (0.148-inch) galvanized steel wire for attachment of fabric to line posts and rails.
- C. Post Caps: Weathertight closure cap for each post. Provide line post caps with loop to receive top rail. Caps shall be shaped as indicated on the Drawings.
- D. Brace and Tension (stretcher bar) Bands: 12-gage (0.105-inch) galvanized pressed steel by 3/4-inch formed to a minimum 300 degree profile curvature for post attachment. Secure bands using minimum 5/16-inch galvanized carriage bolt and nut.
- E. Tension (stretcher) Bars: Galvanized steel one piece length equal to 2 inches less than full height of fabric with a minimum cross-section of 3/16-inch by 3/4-inch. Provide tension bars where chain link fabric is secured to the terminal posts.

- F. Truss Rod Assembly: Galvanized steel minimum 5/16-inch diameter truss rod with pressed steel turnbuckle.

2.6 GROUT AND ANCHORING CEMENT

- A. Concrete: Comply with requirements in Section 033053 “Miscellaneous Cast-in-Place Concrete” for normal weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3,750 psi.
- B. Grout: Nonmetallic, non-corrodible, non-shrink, factory blended and packaged; complying with ASTM C 1107; recommended by manufacturer for exterior use.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, concrete work, and other conditions affecting performance of the Work.
 - 1. Do not proceed with installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fence according to ASTM F 567 and manufacturers written instructions.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
 - 1. If not indicated on drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 12 inch diameter.
 - 2. Unless otherwise indicated, excavate hole depths approximately 6 inches lower than post bottom, with bottom of posts set below finish grade surface as indicated on details.
- C. Post Setting: Center and align posts in holes 3 inches above bottom of excavation. Space maximum 10 feet o.c., unless otherwise indicated.
 - 1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

- a. Unless otherwise indicated, extend concrete footings 2 inches above grade and trowel to a crown to shed water.
 - b. Remove concrete forms and backfill all concrete.
- D. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- E. Top Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- F. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave not more than 3/4 inches between finish grade and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- G. Tie Wires: Use U-shaped wire of proper length to secure fabric firmly to posts and rails with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
- 1. Maximum Spacing: Tie fabric to line posts at 15 inches o.c. and to rails and braces at 24 inches o.c.
- H. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.3 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.4 ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

END OF SECTION 323110